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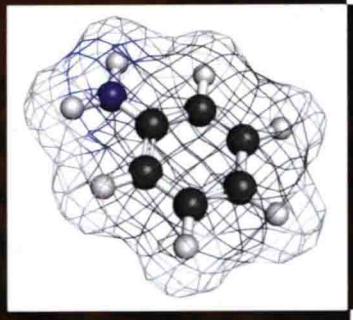
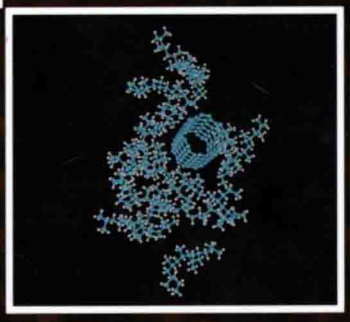
POLYANILINE BLENDS, COMPOSITES, AND NANOCOMPOSITES





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P. M. VISAKH, CRISTINA DELLA PINA
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Polyaniline Blends, Composites, and Nanocomposites summarizes recent advances in polyaniline (PANI)-based blends, composites, and nanocomposites. This book covers the preparation, characterization, and application of PANI-based composites, including the structure–property relationship and modification of PANI. Contributions from leading researchers in industry, academia, government, and private research institutions worldwide offer in-depth coverage on major findings and observations in the field of PANI-based blends, composites, and nanocomposites. This book provides an application-oriented, practical approach that will enable polymer scientists and engineers to effectively utilize PANI in new ways.

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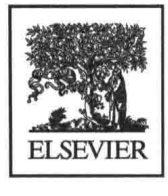

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Preface

This book *Polyaniline Blends, Composites, and Nanocomposites* summarizes many of the recent research accomplishments in the area of polyaniline-based blends, composites, and nanocomposites. In this book, we try to discuss many topics such as polyaniline structure–properties relationship; modification of polyaniline, polyaniline nano/micromaterials-based blends and composites; polyaniline-based thermoplastic blends; polyaniline-based blends: natural rubber and synthetic rubber; polyaniline-based composites and nanocomposites; characterization of polyaniline-based blends, composites, and nanocomposites, polyaniline/natural polymer composites and nanocomposites; applications of polyaniline-based blends, composites, and nanocomposites; and polyaniline–nanomaterials composites: structural, optical, and electrical properties.

This book is intended to serve as a "one-stop" reference resource for important research accomplishments in the area of polyaniline-based blends, composites, and nanocomposites.

This book will be a very valuable reference source for university and college faculties, professionals, postdoctoral research fellows, senior graduate students, and researchers from R&D laboratories working in the area of polyaniline-based blends, composites, and nanocomposites. The various chapters in this book are contributed by prominent researchers from industry, academia, and government/private research laboratories across the globe. It covers an up-to-date record on the major findings and observations in the field of polyaniline-based blends, composites, and nanocomposites. Chapter 1 discusses the introduction, scope, state of art, preparation methods, environmental concerns with regard to nanoparticles, and challenges and opportunities of polyaniline-based blends, composites, and nanocomposites.

Chapter 2, entitled Polyaniline: Structure and Properties Relationship, gives an overview of the structure–property relationship and discusses the synthesis, structures, properties, and applications of PANI. Electrical, electrochemical, nanostructured morphological properties also were discussed in this chapter. To meet requirements of different applications, both nanostructures and properties need to be tuned. Doping phenomena can influence both structures and properties significantly leading to diversification of applications. Modification of polyaniline is discussed in Chapter 3. In this chapter, modification of PANI via gamma irradiation, electron beam irradiation, and ion implantation technique is discussed in detail. The principles of all these techniques are also elaborated. The effect of gamma and electron beam irradiations on different properties including cross-linking, microstructure, mechanical and wear properties, degradation and oxidative behavior, stability and solubility of PANI are explained.

Chapter 4, Polyaniline Nano-/Micromaterials–Based Blends and Composites, discusses many topics such as polyaniline nano-/micromaterials–based blends preparation; composites preparation with different methods such as dispersion polymerization method, sonochemical route, electrochemical methods, in situ polymerization technique, and emulsion polymerization pathway. Chapter 5, Polyaniline-Based

Thermoplastic Blends, summarizes many topics such as preparation, characterizations, properties, and applications. There are four main preparation methods that were discussed by authors, such as in situ polymerization of aniline in a TP matrix; emulsion pathways, NP/PANI/TP blends by in situ polymerization; ex situ blends; and electrochemical synthesis. In the properties section, topics such as morphology, transport properties, thermomechanical properties, and rheological properties are discussed. And in the final section, applications of PANI such as gas sensors, welding of plastics, corrosion protection, electronic devices, membranes and radar absorbing materials are discussed.

Chapter 6 provides a good structure on polyaniline-based blends: natural rubber and synthetic rubber. This chapter discusses two main topics such as polyaniline-based natural rubber blends and polyaniline-based synthetic rubber blends. In each topic, the authors discuss preparation, properties, and applications. Chapter 7, Polyaniline-Based Composites and Nanocomposites, is devoted to the review of many topics such as polyaniline–TiO_2 nanocomposites, polyaniline–calcium carbonate composites, natural fiber–based polyaniline composites, filler-based polyaniline composites, polyaniline–silica nanocomposites, polyaniline–clay nanocomposites, polyaniline–manganese dioxide nanocomposites, polyaniline–porous carbon composites, polyaniline–copper nanocomposites, polyaniline–montmorillonite nanocomposites, polyaniline–graphene nanocomposites, and cellulose whiskers–polyaniline nanocomposites.

The authors of Chapter 8 discuss characterization of polyaniline-based blends, composites, and nanocomposites. In this chapter, authors explained many characterization techniques and their use in polyaniline-based composite materials. Various topics such as mechanical properties, dynamic mechanical analysis, thermogravimetric analysis, differential scanning calorimetry, scanning electron microscopy, atomic force microscopy, transmission electron microscopy, X-ray diffraction, small angle X-ray scattering analysis are discussed. In Chapter 9, authors discuss the composites of polyaniline with different natural polymers such as cellulose, chitin, starch, etc. The authors also explain modifications of each natural materials and discuss the effect of modification on the properties of each composites. In the final section of each topic, their applications are also well explained.

Chapter 10 discusses the applications of polyaniline-based blends, composites, and nanocomposites. In this chapter, authors explain methods of synthesis of PANI and synthesis of PANI-based materials in the introduction part. And second part discusses applications of PANI-based composite for electronic and conducting applications. Chapter 11 gives a brief account on other applications of polyaniline-based blends, composites, and nanocomposites. In this chapter, authors explain many applications of polyaniline-based composites such as application in energy storage, application in corrosion, application in EMI shielding, application in PANI composites. And finally, major challenges and future scope of work are explained in this chapter. The last chapter of this book, entitled Polyaniline–Nanomaterial Composites: Structural, Optical, and Electrical Properties, discusses the recent progress in the polyaniline–nanomaterial composites field. And authors

explain several topics such as synthesis of nanomaterials, characterizations, structural properties, and optical properties.

Finally, the editors would like to express their sincere gratitude to all the contributors of this book, who made excellent support to the successful completion of this venture. We are grateful to them for the commitment and the sincerity they have shown toward their contribution in the book. Without their enthusiasm and support, the compilation of a book could have not been possible. We would like to thank all the reviewers who have taken their valuable time to make critical comments on each chapter. We also thank the publisher **Elsevier** for recognizing the demand for such a book and for realizing the increasing importance of the area of "Polyaniline-Based Blends, Composites, and Nanocomposites," and for starting such a new project, in which not many other publishers put their hands on.

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