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Wenping Hu would like to dedicate this book to Prof. Daoben Zhu on the occasion of his 70th birthday, to Prof. Yunqi Liu for his retirement, and to Qiong and Beining, his wife and daughter, for all their patience and encouragement.

Preface

As a novel emerging science with great applications, organic optoelectronics has attracted the world's attention since the 1990s. Organic optoelectronic materials with special functionalities stem from our increasing ability to manipulate and tune the properties of organic and polymeric materials. This is achieved through a systematic variation of the materials' molecular components, so as to allow for a molecular-level control of the solid-state structure via an arrangement of the functional molecular components into a defined architecture. The optical and electronic processes in organic molecules and polymers govern the behavior of organic semiconductors and their applications in organic optoelectronic devices. Emphasis is placed on the use of organic thin films in active organic devices, including organic light-emitting diodes (OLEDs), organic photovoltaic (OPV) devices, organic field-effect transistors (OFETs), photodetectors, chemical sensors, memory cells and electrochromic devices, as well as xerography and organic nonlinear optics. For example, OLEDs have permitted the development of superior flat-panel display technologies that have now been commercialized for cellular telephone applications, and will soon be implemented in large-area, high-definition television screens. Currently, OPV devices have reached a quantum efficiency of over 9%, which makes them attractive for delivering cheap solar power, while the use of OFETs has led to in a revolution in the development of fast and inexpensive integrated circuits on plastic substrates based on organic semiconductor elements. When combined with their advantage of solution processability, organic materials allow for the use of a variety of printing techniques, such as inkjet printing and stamping, to fabricate large-area devices at low cost. Moreover, the mechanical properties of organic semiconductors also allow for flexible electronics. Certainly, the most distinguishing feature of organic semiconductors is their chemical versatility, which permits the incorporation of functionalities by molecular design, for example, to encode factors that help to direct the properties. Clearly, as an exciting research field with many potential practical applications, organic optoelectronics is progressing at an extremely rapid pace.

The intention of this book is to describe the fundamental scientific information and recent breakthroughs relating to both the basic science and real application of organic optoelectronics. Attention will be focused on the optoelectronic behavior of organic semiconductors, and their applications in new optoelectronic devices.

The book covers topics of: (i) organic semiconductors in electronics, such as FETs and circuits; (ii) organic electroluminescent materials and devices (though here only polymer electroluminescent materials and devices are given as examples); (iii) organic photonics, materials, and devices; and (iv) organic semiconductors in photoabsorption and energy conversion, such as organic solar cells and organic thermoelectric power devices. The preparation of functional materials and the fabrication of novel devices–for example, materials synthesis and purification, physical chemical properties, and the basic processes and working principles of the optoelectronic devices–are all emphasized in this book.

We hope that this book will attract the attention of graduate students and young scientists alike, as well as those more senior academic and industrial researchers who are interested in organic optoelectronics. We believe that this book will provide stimulation for the derivation of ideas, methods, and technologies related to chemistry, physics, materials science, semiconductors, electronics, nanotechnology, and biology in this exciting area.

We conclude by thanking all of the authors for their great contributions to the book, notably their hard work, expertise and insightful suggestions. It would have been impossible to complete this volume without their knowledge, dedication, and enthusiasm. Finally, we express our gratitude to Esther Levy and Ulrike Werner at John Wiley & Sons, Ltd for their help and guidance through the editorial process.

Wenping Hu

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