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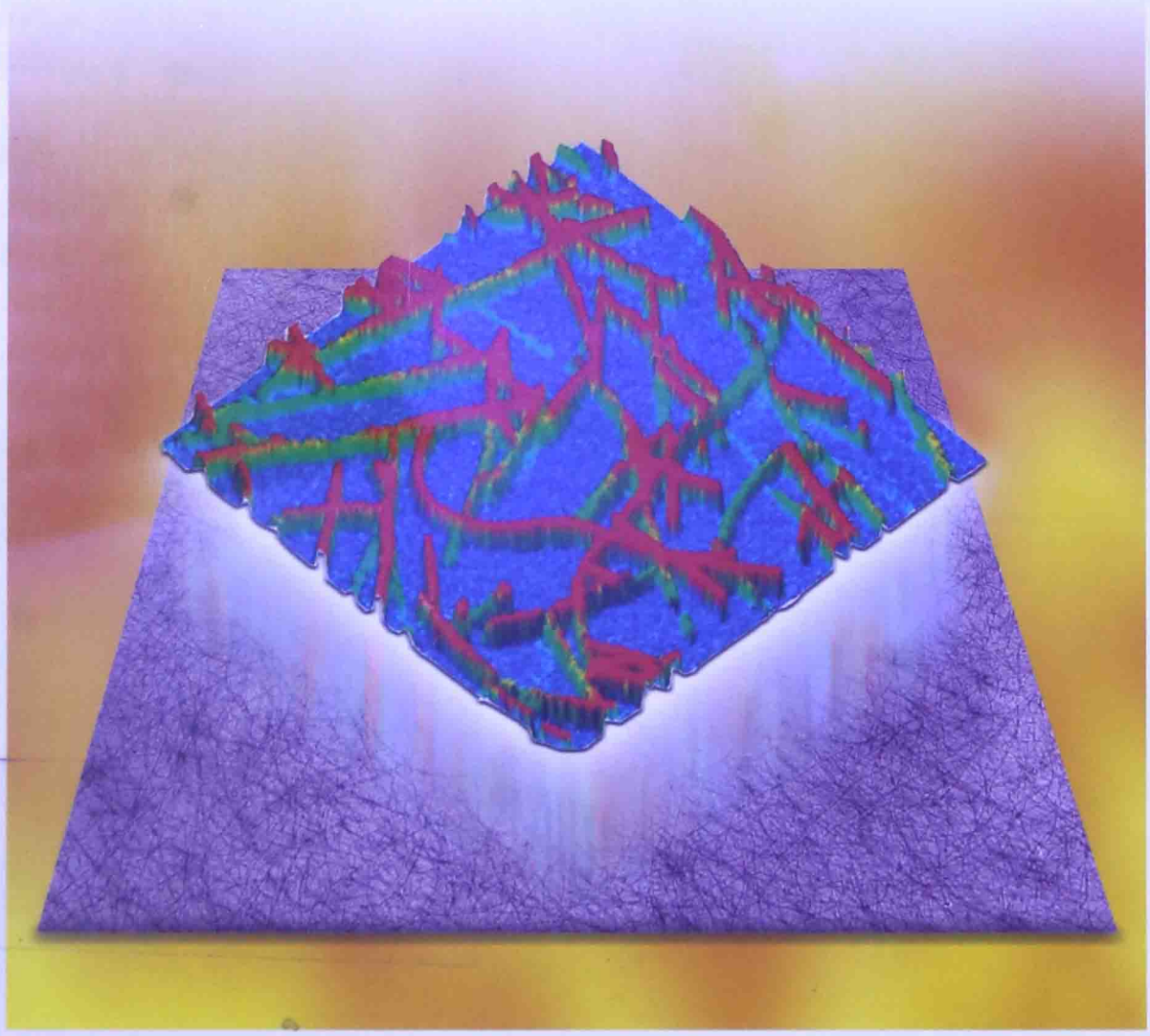
Semiconducting Polymer Composites

Principles, Morphologies, Properties and Applications



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Preface

The research on (semi-)conducting polymers has attracted dramatically increased attention from both academic and industrial communities. The commercial products based on these new materials, for example, polymer thin-film displays and polymer solar cells, are already available on the market. Solution-based thin-film deposition technology makes it possible to carry out large-scale device fabrication with very low cost, which has been regarded as the most attractive advantage of semiconducting polymers for applications in next-generation optoelectronic devices. In most cases, a composite instead of only one polymer species is employed to realize the specific functionality of the device, which results in more scientific questions that need to be answered, for example, with respect to morphological, interfacial, and mechanical properties as well as to charge transfer mechanisms within the composite film. A book collecting the already existing knowledge on the respective topics is necessary for new researchers to become acquainted with the field as well as for giving an overview and addressing the key questions within a short time. In addition, this book aims at giving a systematic and in-depth coverage of semiconducting polymer composites from their fundamental concepts to morphology control and their applications in real devices for researchers already working in the field. Consequently, particular attention is given to the unique advantages of semiconducting polymer composites where polymers with specific functionalities are employed to form a multicomponent material with a desired morphology in order to obtain required materials properties and high-performance devices.

This book contains three parts, where the first part describes the principles and concepts of semiconducting polymer composites, including the mechanism of morphology formation, morphology characterization, energy level alignment at interfaces, energy transfer between the components, percolation theory, and processing techniques. These composites can be classified into two categories in terms of functionality of the components, mainly the matrix polymer involved, which is detailed in Parts II and III, respectively. Part II discusses the semiconducting/insulating polymer composites where a conjugated polymer or an organic semiconductor is dispersed in an insulating polymer matrix, forming a composite with exceptional properties. Part III is concerned with semiconducting/semiconducting polymer composites where conjugated polymers are used as the matrix. The

applications of these composites in, for example, polymer solar cells, light-emitting diodes, transistors, and biosensors are presented.

I am greatly indebted to my colleagues who have been working in the respective fields for years and have agreed to contribute their expertise to this book. Their support made it possible to present the current state-of-the-art overview of semiconducting polymer composites in terms of both its academic value and potential applications.

I would also like to thank the people at Wiley-VCH who offered me this opportunity initially, helped me to overcome numerous difficulties, and made it become reality eventually.

Changchun, China
April 2012

Xiaoniu Yang

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