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Handbook of Multiphase Polymer Systems

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WILEY

Handbook of Multiphase Polymer Systems

Volume 2

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Foreword

Multiphase polymer systems have been the focus of recent research and have become an important issue from both the industrial and fundamental points of view. The scientific literature devoted to multiphase polymer systems is large and growing as it covers a wide range of materials such as composites, blends, alloys, gels and Interpenetrating Polymer Networks.

During the last two decades, major opportunities have appeared due to the possibility of tuning the different relevant length scales with the promise to produce a new generation of materials displaying enhanced physical, mechanical, thermal, electrical, magnetic, and optical properties. In spite of these intensive investigations, there are still many unresolved problems in this field. One of the main issues is the influence of the shape, size and dispersion of the particles in the polymer matrix on the macroscopic behavior of the resulting material. There are many factors which control the dispersion, and one of them is the interaction between the particles and the polymer phase. Describing the interactions between the various components, the physical attributes of polymers and particles, the physical, thermophysical and interfacial properties in a comprehensive universal scheme remains a challenge. This approach requires collecting a large number of experimental data that can be obtained only by using various and complementary experimental techniques.

Investigations in this field cover different topics, such as polymer blends and composites and nanocomposites reinforcement, barrier properties, flame resistance, electro-optical properties, etc. Part of these multiphase polymer materials belong to the so-called smart materials which are materials that have one or more properties that can be significantly changed in a controlled fashion by external stimuli. The key to the success of these smart materials hinges on the ability to exploit the potential of nano-structuring in the final product.

This book discusses many of the recent advances that have been made in the field of morphological, interfacial, physical, rheological and thermophysical properties of multiphase polymer systems. Its content is original in the sense that it pays particular attention to the different length scales (macro, micro and nano) which are necessary for a full understanding of the structure–property relationships of multiphase polymer systems. It gives a good survey of the manufacturing and processing techniques needed to produce these materials. A complete state-of-the-art is given of all the currently available techniques for the characterization of these multiphase systems over a wide range of time and space scales. Theoretical prediction of the properties of multiphase polymer systems is also very important, not only to analyze and optimize material performance, but also to design new material. This book gives a critical summary of the existing major analytical and numerical approaches dealing with material property modeling. Most of the applications of these smart materials are also reviewed which shows clearly their important impact on a wide range of the new technologies which are currently used in our daily life. Finally, the ageing, degradation and recycling of multiphase polymer systems is not forgotten and some routes are proposed to avoid environmental contamination.

The 52 contributors of this book are all leading researchers in their respective fields, and I warmly congratulate the editors Abderrahim Boudenne, Yves Candau, Laurent Ibos and Sabu Thomas for bringing them together to produce this original and important book dealing on multiphase polymer systems.

I am quite convinced that this book will serve as a reference and guide for those who work in this area or wish to learn about these promising new materials.

Dominique Durand

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