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The series *Advances in Polymer Science* presents critical reviews of the present and future trends in polymer and biopolymer science. It covers all areas of research in polymer and biopolymer science including chemistry, physical chemistry, physics, material science.

The thematic volumes are addressed to scientists, whether at universities or in industry, who wish to keep abreast of the important advances in the covered topics.

Advances in Polymer Science enjoys a longstanding tradition and good reputation in its community. Each volume is dedicated to a current topic, and each review critically surveys one aspect of that topic, to place it within the context of the volume. The volumes typically summarize the significant developments of the last 5 to 10 years and discuss them critically, presenting selected examples, explaining and illustrating the important principles, and bringing together many important references of primary literature. On that basis, future research directions in the area can be discussed. *Advances in Polymer Science* volumes thus are important references for every polymer scientist, as well as for other scientists interested in polymer science - as an introduction to a neighboring field, or as a compilation of detailed information for the specialist.

Review articles for the individual volumes are invited by the volume editors. Single contributions can be specially commissioned.

Readership: Polymer scientists, or scientists in related fields interested in polymer and biopolymer science, at universities or in industry, graduate students.

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Finizia Auriemma • Giovanni Carlo Alfonso •
Claudio De Rosa
Editors

Polymer Crystallization I

From Chain Microstructure to Processing

With contributions by

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Preface

The APS volumes “Polymer Crystallization: From Chain Microstructure to Processing” appear about 10 years after the three APS volumes (180, 181, and 191) “Interphases and Mesophases in Polymer Crystallization” edited by Giuseppe Allegra. The volumes follow a series of workshops on polymer crystallization held in Genova in 2010, 2012, and 2014, which were triggered by the need to stimulate debate and share new ideas among leading scientists from academia and industry on emerging topics related to the crystallization of polymers. We decided to collect some of these contributions into two APS volumes, eventually including the contributions of additional authors to fix the new concepts, ideas, and findings into a unified project reflecting the state of art.

With the development of new theoretical and experimental tools for investigating matter at the atomic level, significant advances in the understanding of phenomena associated with polymer crystallization have been achieved. However, elucidating the fundamental physical and chemical issues that govern the crystallization process in a polymer, by which chain molecules move from the melt state to a semicrystalline state with formation of lamellar crystals, is still a challenge.

The volumes include a wide range of different topics. The first section of Volume I is related to molecular aspects of polymer crystallization, with chapters on polymorphism (“Crystallization of Statistical Copolymers”), properties of statistical copolymers (“Molecular View of Properties of Random Copolymers of Isotactic Polypropylene”), the crystallization of cyclic polymers (“Crystallization of Cyclic Polymers”), and precision ethylene copolymers (“Crystallization of Precision Ethylene Copolymers”). This section ends with a chapter devoted to the crystallization of giant molecules (“Supramolecular Crystals and Crystallization with Nanosized Motifs of Giant Molecules”). The second section of Volume I deals with two different basic aspects of the nucleation process that are also important in industrial processes: self-nucleation (“Self-nucleation of Crystalline Phases Within Homopolymers, Polymer Blends, Copolymers and Nanocomposites”) and nucleation at high supercooling (“Crystal Nucleation of Polymers at High Supercooling of the Melt”).

Volume II begins with a section concerning aspects of polymer crystallization that have often been overlooked in the literature and are related to concomitant crystallization and cross-nucleation (“Concomitant Crystallization and Cross-Nucleation in Polymorphic Polymers”), surface-induced epitaxial crystallization (“Epitaxial Effects on Polymer Crystallization”), and study of the origin of banded spherulites with nanofocus X-ray diffraction (“Microstructure of Banded Polymer Spherulites: New Insights from Synchrotron Nanofocus X-Ray Scattering”). The two latter chapters are illustrative examples of modern investigation of crystal morphology at the molecular level. The second section of Volume II collects important issues in industrial application and processing. Topics includes the use of synchrotron light for studying phase transformation during processing or deformation in real time (“Real-Time Fast Structuring of Polymers Using Synchrotron WAXD/SAXS Techniques”), the role of amorphous phase in stress-induced crystallization of natural rubber (“Strain-Induced Crystallization in Natural Rubber”), the influence of cooling rate and pressure on polymer crystallization (“Non-isothermal Crystallization of Semicrystalline Polymers: The Influence of Cooling Rate and Pressure”), and the modeling of flow-induced crystallization (“Modeling Flow-Induced Crystallization”).

We are thankful to all contributors to the project for their high quality work.

These two volumes cover only a few aspects of polymer crystallization, and final solutions to the big problems in the field have not been assessed. Several topics covered in the volumes are still under development and need additional in-depth analyses, checks, and improvements. Nonetheless we hope that the selected topics will stimulate new discussions, inspire new theories and experiments, intrigue new followers, and initiate new research in this fascinating world.

Napoli, Italy

Genova, Italy
04 July 2016

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