HANDBOOK OF POLYMER SYNTHESIS, CHARACTERIZATION, AND PROCESSING

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To Amparo, Adriana and Andrés, with love
To Adriana, Eduardo Abraham and Luis Ángel, with appreciation and love

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PREFACE

The industry of polymers is very complex, in part because it encompasses many aspects that are of multidisciplinary nature. The chain of production of polymers requires expert knowledge in different areas: (i) polymer synthesis, both from the chemistry and the engineering aspects; (ii) polymer characterization, including chemical, physicochemical, rheological properties and others; and (iii) polymer processing and transformation into final products.

The aim of this handbook is to serve as the first source and comprehensive reference to all aspects of interest in the polymer industry. Given the complexity of this industry and the specialized knowledge required in each area of polymer production and application, most of the books dealing with polymer science and technology cover only some aspects of the polymer production chain; however, we believe that a professional working in the polymer industry or, in general, in polymer science and technology would greatly benefit from a book summarizing all the aspects involved in the production chain of the polymer industry. The book has been written with the underlying idea of meeting this need. An effort has been made in every chapter to include the fundamentals of the chapter's subject, the relevant literature, and the new trends in the field.

The book is addressed mainly to professionals in virtually all positions in the polymer industry: manufacturing, quality control, R&D, sales, technical assistance, and so on. Another group of potential readers is the undergraduate and graduate students in fields related to polymer science and technology. Finally, academic researchers of universities and institutes, working in different areas of polymerization and polymers, will find the book useful for expanding their knowledge beyond their area of expertise. The book can be used to establish the first approach to a specific topic by anyone in the target audience, to broaden the knowledge of industrial practitioners wanting to know more about the polymer production chain, and to look for references in order to deepen the understanding of specialized aspects of a topic. It can also be used as a textbook in the first course in polymer science or engineering, at the undergraduate or graduate level, especially if a broad coverage of the field is desired.

After an introduction to the basic concepts of polymers and polymerization (Chapter 1) and thermodynamic polymer states (Chapter 2)[1], the second part of the handbook is devoted to the main synthesis techniques of polymers (Chapters 3–5 and 7–8), including chapters covering concepts that may be applicable to all the synthesis techniques (crosslinking and grafting in Chapters 9 and 10, respectively). The important subject of copolymers (Chapter 6) is also included in this section, as synthesis and structure are closely related areas. The subject of additives is included in the synthesis section because, from the point of view of properties and applications, they have become an important part of the polymeric material being synthesized. The third part of the handbook is dedicated to the engineering principles and the different types of polymerization processes used in industry (Chapters 12–14); the new trends, from an engineering perspective, are also discussed (Chapter 15). Part IV, which includes Chapters 16–21, provides the scope of the main techniques used for polymer characterization and testing, at both the fundamental and the applied levels. Chapters 22–28 cover polymer processing principles, techniques, and equipment. Chapter 28 (Thermosetting Polymers) is included here because of the emphasis on industrial processes, although it implies simultaneous reaction and shaping. Finally, Chapters 29–31 deal with advanced

[1]Some important thermodynamic concepts related to polymers are dealt with in Chapter 25.

and more specialized subjects in the polymer field, which are of increasing importance (nanomaterials, dendrimers, and conjugated polymers).

The handbook represents the joint effort of a large number of scientists and researchers working in the many diverse fields of polymer science and technology. Many years of study and experience have been put together in an organized manner in this work; hopefully, the handbook will serve its purpose with a large audience.

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