

Polymer Physics

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Preface

This book introduces the reader to the fascinating field of polymer physics. It is intended to be utilized as a textbook for teaching upper level undergraduates and first year graduate students about polymers. Any student with a working knowledge of calculus, chemistry, and physics should be able to read this book. The essential tools of the polymer physical chemist or engineer are derived in this book without skipping any steps. Hence, the book is a self-contained treatise that should also serve as a useful reference for scientists and engineers working with polymers.

While the book assumes no prior knowledge of polymers, it goes far beyond introductory polymer texts in the scope of what is covered. The fundamental concepts required to fully understand polymer melts, solutions and gels in terms of both static structure and dynamics are explained in detail. Problems at the end of each chapter provide the reader with the opportunity to apply what has been learned to practice. More challenging problems are denoted by an asterisk.

The book is divided into four parts. After an introduction in Chapter 1, where the necessary concepts from a first course on polymers are summarized, the conformations of single polymer chains are treated in Part 1. Part 2 deals with the thermodynamics of polymer solutions and melts, including the conformations of chains in those states. Part 3 applies the concepts of Part 2 to the formation and properties of polymer networks. Finally, Part 4 explains the essential aspects of how polymers move in both melt and solution states. In all cases, attention is restricted to concepts that are firmly entrenched in the field, with less established uses of those concepts relegated to the problems.

The motivation for our writing this book comes from the fact that its primary antecedent, written by Paul Flory, is now 50 years old. Many of the same concepts are re-introduced in modern language. Other concepts introduced by eminent scientists over the past half-century are derived in simpler ways, with the intention of making them accessible to a broader audience. These include many of the important concepts discussed in the excellent monographs by de Gennes and by Doi and Edwards.

The book is titled Polymer Physics largely because the authors share the viewpoint of Lord Ernest Rutherford:

'Science is divided into two categories, physics and stamp-collecting.'

The foundations of this book arose from debates between the authors while they were employed for 10 glorious years at the Eastman Kodak Company. While the authors continue to debate many aspects of science, the contents of this book have emerged as the essence of what they claim to

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understand in polymer physics, bearing in mind the wisdom of Werner Heisenberg:

'Science progresses not only because it helps to explain newly discovered facts, but also because it teaches us over and over again what the word understanding may mean.'

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