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POLYMER SOLUTIONS

POLYMER SOLUTIONS

An Introduction to Physical Properties

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To my wife, Sadae

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PREFACE

The purpose of this textbook is twofold. One is to familiarize senior undergraduate and entry-level graduate students in polymer science and chemistry programs with various concepts, theories, models, and experimental techniques for polymer solutions. The other is to serve as a reference material for academic and industrial researchers working in the area of polymer solutions as well as those in charge of chromatographic characterization of polymers. Recent progress in instrumentation of size exclusion chromatography has paved the way for comprehensive one-stop characterization of polymer without the need for time-consuming fractionation. Size-exclusion columns and on-line light scattering detectors are the key components in the instrumentation. The principles of size exclusion by small pores will be explained, as will be principles of light-scattering measurement, both static and dynamic.

This textbook emphasizes fundamental concepts and was not rewritten as a research monograph. The author has avoided still-controversial topics such as polyelectrolytes. Each section contains many problems with solutions, some offered to add topics not discussed in the main text but useful in real polymer solution systems.

The author is deeply indebted to pioneering works described in the famed textbooks of de Gennes and Doi/Edwards as well as the graduate courses the author took at the University of Tokyo. The author also would like to thank his advisors and colleagues he has met since coming to the U.S. for their guidance.

This book uses three symbols to denote equality between two quantities A and B.

1) 'A = B' means A and B are exactly equal.
2) 'A $\cong$ B' means A is nearly equal to B. It is either that the numerical coefficient is approximated or that A and B are equal except for the numerical coefficient.
3) 'A $\sim$ B' and 'A $\propto$ B' mean A is proportional to B. The dimension (unit) may be different between A and B.

Appendices for some mathematics formulas have been included at the end of the book. The middle two chapters have their own appendices. Equations in the book-end appendices are cited as Eq. Ax.y; equations in the chapter-end appendices are cited as Eq. x.A.y; all the other equations are cited as Eq. x.y. Important equations have been boxed.

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