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Reviewed in this issue:

2 software packages
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Structured fluids: polymers, colloids, surfactants

Subject area
Condensed-matter physics; physical chemistry.

Description
This book provides a comprehensive introduction to the physics of soft-matter systems – such as polymers, colloids, and surfactants – and presents a unified description using concepts such as scaling. The text is suitable for advanced chemistry and physics undergraduates, and postgraduates embarking on research in soft condensed matter physics.

Authors
Thomas A Witten with Philip A Pincus.

Publishers/Suppliers
Oxford University Press (http://www.oup.co.uk).

Date/Edition
2004.

ISBN
0-19-852688-1.

Level
Undergraduate, research.

Price
£39.95.

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October 2004

This new book is an introduction to the physics of soft-matter systems – such as polymers, colloids, and surfactants – and is intended to furnish the advanced undergraduate reader with a unified view of these complex materials using fundamental concepts in statistical physics.

Summary Review

range: * poor to ***** good	
Academic content	*****
Usefulness to student	*****
Usefulness to teacher	***
Meets objectives	*****
Accuracy	*****

The text begins with a brief survey of the materials and phenomena to be explored throughout the book; the examples are well chosen, and they motivate the reader to find out more. The next chapter – entitled Fundamentals – lays down some fundamental ideas in statistical mechanics in an intuitive fashion that will probably be unfamiliar to most members of the target audience. Some of the standard results – such as the free energy of a lattice gas – seem to be obtained by routes more tortuous than are strictly necessary, but probably this just reflects my personal taste for a more dogmatic approach. Nonetheless, the central themes, e.g., the ability of a system to do work, underpin and unify much of what follows and hence I feel that this unconventional review would pay dividends for an inexperienced reader. The chapter also includes a description of experimental techniques for the study of soft matter, and a useful discussion on the viscosity of fluids. The remaining five chapters then explore specific areas of soft-matter physics, these being polymer molecules, polymer solutions, colloids (including colloidal crystals, ferrocolloids, and lyotropic liquid crystals), interfaces, and surfactants.

The chapters are individually well constructed and comprehensive, while as a whole they possess a coherence which helps achieve the stated goal of a unified treatment. For instance, scaling laws are carefully described in the chapters on polymers, and then employed throughout the text with such effectiveness that by the end one feels sufficiently well equipped to tackle new problems. The text was, perhaps, a little vague when describing chemical aspects of complex molecules, but then the focus is the description of the physical properties of soft matter, so I don't see this as a significant problem. There are sufficient references to help guide the reader towards the relevant primary literature. The style of writing is quite informal, which makes the text easy to read and complements the necessarily semi-quantitative treatments of such complex materials. The production quality of the book is generally very high; I could find no significant errors, although corrections and additions will be made available on the Oxford University Press web site.

Problems are distributed throughout the book, and these are important features that complete the logical progression of the text. I think that this device works well in treatments of more advanced undergraduate topics, although it would not be particularly helpful for lecturers aiming for more structured courses who might benefit from a collection of problems at the end of each chapter. Interestingly, the text is augmented by suggestions for illustrative experiments involving nothing more sophisticated than ordinary household materials and a laser pointer. I was motivated to try some of these experiments – such as the salting out of casein micelles from skimmed milk – and I think these are of enormous pedagogical value, and good fun!

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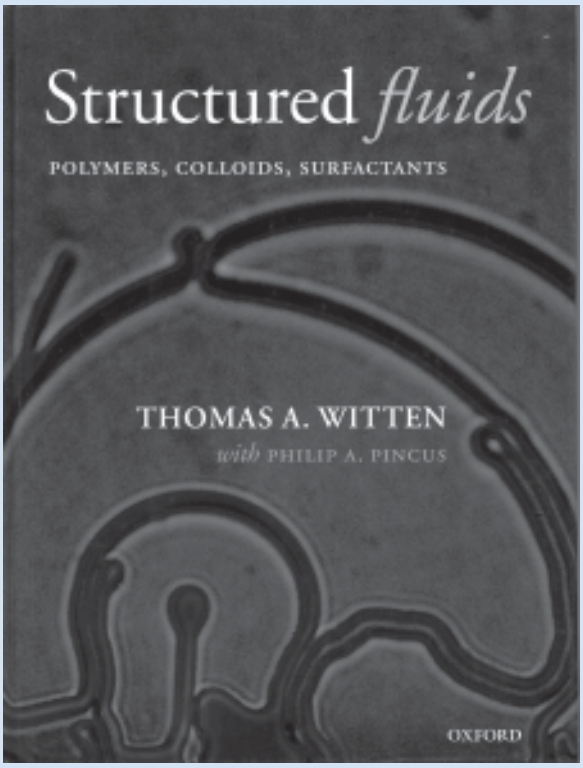
Structured fluids: polymers, colloids, surfactants



From the publisher...

Structured Fluids - Polymers, Colloids, Surfactants

Thomas A Witten, James Franck Institute, University of Chicago, Illinois, USA

This book teaches undergraduates in physical science how to understand soft matter: fluids containing polymers, colloidal particles or surfactant molecules. These fluids are playing an increasing role in biotechnology and in basic science. The book gives a unified account of their distinctive properties such as their large viscosities or their weak elasticity using basic statistical principles.
Readership: Advanced undergraduate and beginning graduate students in physical and biological science, as well as chemical engineering. Will also be of use to industrial scientists.

0-19-852688-1 240pp 2004 £39.95

Continued from page 27

Soft condensed matter is of relevance in a wide variety of biological, chemical, physical, and industrial contexts, and it therefore deserves significant exposure in undergraduate chemistry and physics courses. Since the description of condensed matter systems requires grounding in statistical mechanics, the final years of study are probably most appropriate, and the text is indeed aimed primarily at advanced (US) undergraduates. Of course, this is not the first text to deal with soft-matter physics, and the authors preface the book with a comprehensive survey of relevant advanced texts, such as de Gennes' classic monograph, "Scaling concepts in polymer physics"[1] and Chaikin and Lubensky's, "Principles of condensed matter physics"[2]. What sets "Structured fluids" apart is that it should be fully accessible to an advanced undergraduate with a statistical mechanics course under their belt. In addition, I feel that the book provides a useful introduction to theoretical ideas for postgraduate students starting in, for instance, experimental condensed-matter research.

In summary, this book provides an extremely useful first introduction to the vast area of soft condensed matter physics. It should prove useful for advanced undergraduate lecture courses in polymer physics and colloid science, as well as a valuable introduction to the topic for starting postgraduates. Moreover, I can wholeheartedly recommend this text for anyone interested in discovering the diversity, excitement, and challenges of soft-matter physics.

References

1. de Gennes, P G *Scaling concepts in polymer physics*, Cornell University Press (1979).
2. Chaikin, P M and Lubensky, T C *Principles of condensed matter physics*, Cambridge University Press (1995).