



Colloids and the Depletion Interaction (Lecture Notes in Physics)

By Henk N.W. Lekkerkerker, Remco Tuinier

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Colloids are submicron particles that are ubiquitous in nature (milk, clay, blood) and industrial products (paints, drilling fluids, food). In recent decades it has become clear that adding depletants such as polymers or small colloids to colloidal dispersions allows one to tune the interactions between the colloids and in this way control the stability, structure and rheological properties of colloidal dispersions. This book offers a concise introduction to the fundamentals of depletion effects and their influence on the phase behavior of colloidal dispersions. Throughout the book, conceptual explanations are accompanied by experimental and computer simulation results.

From the review by Kurt Binder:

"They have succeeded in writing a monograph that is a very well balanced compromise between a very pedagogic introduction, suitable for students and other newcomers, and reviews of the advanced research trends in the field. Thus each chapter contains many and up to date references, but in the initial sections of the chapters, there are suggested exercises which will help the interested reader to recapitulate the main points of the treatment and to deepen his understanding of the subject. Only elementary knowledge of statistical thermodynamics is needed as a background for understanding the derivations presented in this book; thus this text is suitable also for advanced teaching purposes, useful of courses which deal with the physics for soft condensed matter.

There does not yet exist any other book with a similar scope.....

The readability of this book is furthermore enhanced by a list of symbols, and index of keywords, and last not least by a large number of figures, including many pedagogic sketches which were specifically prepared for this book. Thus, this book promises to be very useful for students and related applied sciences alike."

Eur. Phys. J. E (2015) 38: 73

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Editorial Review

Review

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From the Back Cover

Colloids are submicron particles that are ubiquitous in nature (milk, clay, blood) and industrial products (paints, drilling fluids, food). It has been known for a long time that adding salt or polymer influences the characteristics of colloidal suspensions. Think of the Egyptians who engineered ink by adding gum Arabic to soot particles a few thousand years ago. Unknowingly, they were taking advantage of the anchoring of the polysaccharides onto the colloids to provide the stabilization of the soot particles that eventually provided an ink to write on papyrus. The effect of charges and polymers attached to the surface of colloidal particles on their stability has been understood and studied extensively in the last century. But the more elusive, albeit ubiquitous, effects of the addition of free polymers and small colloids as depletants to colloidal dispersions have become in focus recently. In recent decades it has become clear that adding such depletants allows one to tune the interactions between the colloids and in this way control the stability, structure and rheological properties of colloidal dispersions. This book offers a concise introduction to the fundamentals of depletion effects and their influence on the phase behavior of colloidal dispersions. These fundamental principles promote insight and the intuitive sense needed to isolate issues related to depletion effects in technological problems and design critical experiments. In an introductory chapter, the authors provide a historical perspective and the applications of depletion effects not only in colloid science but also in biology, medicine and technology. In the subsequent chapter they address the basics of depletion interactions, including the effects of anisotropic depletants. The next chapter covers the basics of phase behavior in colloidal dispersions, followed by extensions towards mixtures of spherical colloids with polymers or small colloids inducing depletion forces. Finally, the authors consider depletion effects in suspensions of rod-like colloids. Throughout the book, conceptual explanations are accompanied by experimental and computer simulation results. This is an ideal book for advanced undergraduates and graduate students in physical chemistry, chemical engineering and soft matter physics. It provides the basic knowledge of depletion interactions and phase behaviour in general. Experienced scientists and engineers working on polymers, particles or colloidal dispersions, may also find this book useful.

About the Author

Henk N.W. Lekkerkerker (1946) studied chemistry at Utrecht University (The Netherlands) and obtained his doctorate at the University of Calgary (Canada) in 1971. He then moved to Brussels initially as a postdoctoral fellow at the Université Libre de Bruxelles (Belgium) and subsequently became a Professor of Theoretical Physical Chemistry at the Vrije Universiteit Brussel. From 1985 till present he is a Professor of Physical Chemistry at the Van 't Hoff laboratory, Utrecht University and since 2006 he is also Academy Professor of the Royal Netherlands Academy of Arts and Sciences. He received the Bakuys Roozeboom

Gold Medal, the Onsager Medal and the Liquid Matter Prize for his work on phase behavior of colloidal dispersions.

Remco Tuinier (1971) studied food science at Wageningen University (The Netherlands) and performed his PhD work at the NIZO food research institute and Wageningen University on exocellular polysaccharides and protein-polysaccharide mixtures, for which he received the International Food Ingredient Award in 1999. Subsequently, he worked as Postdoctoral fellow at Utrecht University and as Project Leader at NIZO food research and in 2001 became a staff member at the Forschungszentrum Jülich, Germany. Since 2008 he works at DSM Research, Geleen, The Netherlands, presently as Principal Scientist Colloids & Interfaces.

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