Physical Gels from Biological and Synthetic Polymers

Presenting a unique perspective on the state-of-the-art of physical gels, this interdisciplinary guide provides a complete, critical analysis of the field and highlights recent developments. It shows the interconnections between the key aspects of gels, from molecules and structure through to rheological and functional properties, with each chapter focusing on a different class of gel. There is also a final chapter covering innovative systems and applications, providing the information needed to understand current and future practical applications of gels in the pharmaceutical, agricultural, cosmetic, chemical and food industries. Many research teams are involved in the field of gels, including theoreticians, experimentalists and chemical engineers, but this interdisciplinary book collates and rationalizes the many different points of view to provide a clear understanding of these complex systems for researchers and graduate students.

Madeleine Djabourov is Professor at the Ecole Supérieure de Physique et Chimie Industrielles de la Ville de Paris (ESPCI-ParisTech), in charge of thermodynamics and rheology courses. She was involved in pioneering studies on gelation and percolation initiated by Pierre-Gilles de Gennes.

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'Many innovative functional gel materials have been developed over the past decade, and our understanding of physical gels and their functionalities is advancing at a rapid pace, but so far there has been a lack of comprehensive textbooks suited to introduce graduate students, teachers and research workers into the science of physical gels. This wonderful book perfectly fills this need. Written in an elegant and accessible style with lucid concepts, plenty of examples, and spectacular figures, including the authors' original scientific works on rheology and phase transitions, the book takes the readers gently from the most elementary concepts of physical gels to the forefront of current research. The book can therefore be warmly recommended as a textbook or reference work for both undergraduate and graduate courses whether or not the readers are familiar with the subject.'

Fumihiko Tanaka, Kyoto University, Japan

'As a class of fascinating materials, physical gels hold realized and potential application in many fields. This interdisciplinary book provides basic approaches to rationally designing and fabricating a physical gel along with molecular level understanding of the gelation mechanism.'

Hongbin Zhang, Shanghai Jiao Tong University, China

'This book is a very important and original one; with 351 pages, it is devoted to a good and up to date review on physical gels. The 3 authors are well-known in this field and they are able to cover it extensively: the different mechanisms of physical gel formation, especially important in the domain of natural polysaccharides are discussed. The techniques able to characterize the gels at different scales are given in the same time as method for the gel point (sol-gel transition) determination. The cases of proteins, synthetic polymers and polysaccharides are well documented. I can recommend this book for people starting in the field of physical gels and those yet involved in the study of physical gels.'

Marguerite Rinaudo, European Synchrotron Radiation Facility (ESRF)

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Contents

Preface

This book is the result of both long personal friendships and a series of scientific collaborations, between the three authors. Although we have been working in this field essentially independently, as is usual we have also intersected with one another on many occasions in various parts of the globe, and visited each other's facilities. From all of this, we have come to realize that our thoughts have evolved through various aspects of this complex topic. The idea of writing a book represents some culmination of these intersections, both geographical and ideological. This, together with our will to put together our personal views and experiences to try to reflect the specific ways in which the topic has been appreciated in our original cultures and environments, has resulted in this volume.

Writing the book, which is necessarily then the synthesis of our views, has been a matter of considerable debate, because of the large area that the topic obviously covers. Even though this book reflects the overall complexity of this still-developing subject imperfectly, we feel that we have produced an appropriate survey of the present state of art. We hope that the final result could be an introduction to a larger public, but more particularly for physical chemists, condensed matter physicists and all disciplines in between, and that it will encourage other workers to adopt these topics and so to introduce their own ideas and hypotheses.

We wish to acknowledge the fruitful discussions with, and advice from, many distinguished scientists and colleagues. Among these the thoughts and encouragement of Dr Kawthar Bouchemal, Professor Walther Burchard, Professor Allan Clark, Professor Lucilla de Arcangelis, Professor Emanuela Del Gado, Professor Masao Doi, Professor Jacques Leblond, Professor Edwin Morris, Professor Kunio Nakamura, Dr Klaas te Nijenhuis, Professor Marguerite Rinaudo, Professor Fumihiko Tanaka, Professor Masayuki Tokita and Professor Peter A. Williams are especially appreciated.

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