crystalline phases, clearly asymptotically and in a continuous way approaches the already referred to Chaikin and Lubensky classic, appropriately and prominently listed in the Further Reading concluding list.

Selinger’s book is clearly an excellent, well-written introduction to the phenomenology and concepts of soft matter physics. I enjoyed reading it and can but recommend it to students of theoretical physics with an interest in pursuing this research direction, or to those that would need a good background to the contemporary research literature, even if they do not plan to apply and learn the techniques described in the book. I will, and already have, recommended this book to my graduate students with the path to theoretical soft matter physics in mind, as the first that they should read.

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The Oxford handbook of soft condensed matter, edited by E. M. Terentjev and D. A. Weitz, Oxford, Oxford University Press, 2015, 600 pp., hardback £95, 112 Euro, $120, ISBN: 978-0-19-966792-5

The Oxford Handbook of Soft Condensed Matter, edited by Eugene Terentjev and David Weitz, is a comprehensive and introductory compendium of the key aspects of a very broad field of research, known today as Soft Condensed Matter or, in short, Soft Matter. It brings together some of the key players of the field to contribute modern introductions to their field of expertise in approximately 50 pages each, all in all covering topics as diverse as liquid crystals, colloids, granular matter, polymers and biological systems. Despite the breadth of the aspects covered, also the connections between different topics are pointed out. Given the limitations in space, the book provides an overview of many different soft matter systems, pointing out the key achievements and basic underlying principles of each, while surely whole books have been written on each subject covered. And indeed, this is exactly the strength of the present text, providing an introduction of key concepts, with a comprehensive set of references for further reading if desired, all on a bit less than 600 pages.

The discussion of soft condensed matter starts right away in chapter 1 on ‘Colloidal suspensions’, which is written by Wilson Poon from the University of Edinburgh. The topic has a long history, at least going back to the beginning of the last century, and certainly also important applications, e.g. in the food industry. Poon confronts the reader with the question whether or not matter is granular, i.e. can colloids be regarded as atoms? The role of energy versus entropy is discussed for clustering or crystallising colloids, and how the control and tuning between attractive and repulsive interactions can lead to the formation of liquids and glasses. Further, gels are introduced to discuss kinetic arrest. The rheology of colloidal suspensions is discussed and a modern topic, proteins as colloids, is introduced.

Dominique Langevin, from the CNRS Orsay, introduces the topic of ‘Surfactants’ in chapter 2. After a discussion of surface tension and surface rheology, the formation of aggregates of amphiphilic molecules is described. Micelle formation in diluted solutions, also in relation to geometrical aspects, and bulk aggregates in concentrated solutions (lyotropic liquid crystals) are introduced. Microemulsions and non-equilibrium systems complement the discussion, before foams and foam stability are mentioned.

‘Liquid crystals’ is the topic that Oleg Lavrentovich from Kent State University introduces in chapter 3. He distinguishes between thermotropic and lyotropic liquid crystals, i.e. the partially ordered phases formed by simple temperature variation and those formed by anisotropic molecules in an isotropic solvent through variation of concentration. Lavrentovich focuses on some of the modern questions in liquid crystal research, uniaxiality versus biaxiality, frustrated phases, polymer stabilisation, tactoids,
but not without mentioning the classic phases as well: chiral nematics, smectics and columnar phases. The order parameter to describe orientational order is introduced, together with phenomenological and molecular-statistical theories of the nematic state. Elasticity, which plays a large role in pattern formation and instabilities, is established, as is surface anchoring, which then leads to a discussion of the wealth of topological defects. Besides a very short excursion into polymer–liquid crystal hybrid materials, liquid crystal–colloid hybrid systems, which have recently attracted much attention, are discussed in more detail. As liquid crystals have led to a multibillion dollar industry, the chapter concludes with a short survey of the applications of these fascinating materials.

A topic somewhat related to surfactants and lyotropic liquid crystals is that of ‘Foams’, which are introduced in chapter 4 by Denis Weaire and Stefan Hutzler from Trinity College Dublin. The topic is introduced with a short discussion of examples of foams found in everyday life, their general structure and applications, before going into more detail about their static and dynamic properties, equilibrium and curvature. Foam structure, coarsening, coalescence and drainage are described, also in relation to scaling laws observed. Further important key properties are foam rheology, conductivity and light scattering, i.e. optical properties. Stabilisation of foams is discussed through the addition of surfactants, but also for particle-stabilised foams. For the latter, the foam stability can be tuned by changing the hydrophobicity of the dispersed particles through coatings.

Raphael Blumenfeld, Sam Edwards and Stephen Walley from Imperial College London and the Cavendish Laboratory give an introduction into the ‘Physics of granular systems’ in chapter 5. This first includes how the structure of granular matter can actually be described quantitatively, and how stress is transmitted through a macroscopic system of granular matter. This is not a trivial task, so the description of this aspect does take quite a few pages elaborating on different approaches. The mechanical properties are then explained via methods of statistical mechanics.

Chapter 6 by Ronald Larson and Zuowei Wang from the University of Michigan and the University of Reading, respectively, covers a rather different topic of soft condensed matter, the ‘Dynamics of entangled polymers’. Models to describe entanglement are outlined, packing and concentration effects discussed, and also compared to predictions from computer simulations. The standard tube model is introduced in the description of the linear regime of polymer dynamics, i.e. linear viscoelastic phenomena. The model is also applied to branched polymers of different kinds. Moving on to the nonlinear dynamical regime of polymers (Doi-Edwards description and beyond), the modern tube model is discussed, but also unsolved problems pointed out.

Continuing with the theme on polymers, ‘Block copolymers’ are covered in chapter 7 by Lee Trask, Nacu Hernandez and Eric Cochran from Iowa State University. The phase behaviour and microphase separation is discussed and different types of block copolymers, such as triblock copolymers, rod-coil block copolymers and thin films are introduced before the general phase diagrams are shown. Dynamic aspects of block copolymers such as phase separation kinetics, diffusion, viscoelasticity and rheology are covered. Small angle x-ray diffraction and neutron scattering are introduced in detail as a means for structure determination of block copolymers.

Further continuation into the field of polymers with chapter 8, written by James Mark and Burak Erman from the University of Cincinnati and Koç University, respectively, provides a discussion of ‘Elastomers and rubberlike elasticity’. These materials have been studied for a long time, due to their remarkable properties, such as huge reversible deformations, and corresponding counterintuitive thermodynamic behaviour, but also for a diverse range of applications. At first, the preparation and structure of polymer networks is discussed. Elastic experiments are described together with their theoretical interpretations. The chapter also covers elastomers which exhibit an internal microstructure, namely liquid crystalline elastomers, bioelastomers, filled elastomers and elastomer composites with nanotubes or metal particles.

Chapter 9 by Andrey Dobrynin from the University of Connecticut is on ‘Polyelectrolyte solutions and gels’. It reviews the properties of charged polymer chains in a solvent providing counter-ions. This is especially also of importance to biological systems, such as RNA or DNA. Dilute solutions, semi-dilute solutions, salt solutions and semi-dilute solutions with salts are discussed. A mean-field description of the phase separation process in polyelectrolyte solutions is presented, and the properties of polyelectrolyte gels discussed.

Chapter 10 by Masao Doi from the University of Tokyo slightly continues in this spirit, by discussing ‘Fluid transport in gels’. The contribution tackles the question how a fluid is moving through an elastic continuum. Doi starts his description with the equilibrium state of non-ionic gels, before coming to the dynamics of these systems. Both cases are illustrated by an example of a stretched gel sheet. The dynamics of ionic gels is then covered in the last part of the contribution. As an example, the equations are applied to describe an electromechanical transducer.

Chapters 8–10 illustrate the importance of soft condensed matter, i.e. matter that is very easily deformed by small external stimuli, for biological systems. Chapter 11 by Astrid van der Horst and Gijs Wuite from VU University Amsterdam is on ‘Order and disorder in the extracellular matrix’. They describe the hierarchical structure and the properties of a heterogeneous composite system of collagen and elastin proteins, biopolymers which form filaments and networks which are of importance for biological functionality, similar in many respects of self-assembly, but very different in their structural function, collagen providing tensile strength and elastin providing elasticity.
Matthieu Piel and Raphael Voituriez, from the CNRS Paris, continue this theme in chapter 12 on ‘Cell cytoskeleton’. After introducing the cytoskeleton components such as actin filaments, microtubulus, molecular motors, plasma membranes, the cell walls and extracellular matrix, models of the cytoskeleton are discussed, starting with coarse grained models and active gels. The two main contributions of the actin–myosin cytoskeleton to the cellular functions are to be found in cell migration and cell polarity, which are discussed in more detail.

The last chapter on ‘Biological fluid interfaces and membranes’, chapter 13, is written by Aidan Brown and Pietro Cicuta, from the University of Cambridge and University of Edinburgh, respectively. The contribution introduces the components of biological interfaces or membranes, and then discusses fluid interfaces and films, such as lipid bilayers and Langmuir–Blodgett films, while also providing examples of biological films. Membrane mechanics and dynamic motion is discussed extensively for different membrane types, as are multicomponent membranes and those of importance in cell biology.

The Oxford Handbook of Soft Condensed Matter covers a wide breadth of topics in the general area of soft matter, colloids, polymers, liquid crystals, granular matter, gels and biological systems. Obviously only an introduction into these topics can be provided by the key researchers working in the individual fields, while these introductions are well-written, well-illustrated and generally of excellent quality. Soft matter is a very interdisciplinary field, bringing together physics, chemistry, biology, material science and engineering. This text is obviously mainly aimed at physicists. In that respect, I really enjoyed reading the book and will surely keep it in my bookshelf for reference. It provides a very nice view on topics outside of liquid crystal research, but those that are becoming more and more of importance in relation to liquid crystals as the composites involving liquid crystals, especially also lyotropic liquid crystals, are becoming of increasing interest. I can thus without hesitation recommend this book to everyone who wants to become acquainted with other aspects of soft matter, in addition to liquid crystals, and the relations between these topics. This text provides a quick yet very comprehensive introduction to the fascinating world of soft and easily deformable materials.

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