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BOOK REVIEWS

Proteins at Interfaces II: Fundamentals and Applications. Edited by Thomas A. Horbett and John L. Brash, ACS symposium series 602, American chemical society, Washington DC 1995, ISBN 0-8412-3304-7 with 561 pages and more than hundred figures, covers the lectures given at the 207th national meeting of the American Chemical society, San Diego, March 13–17, 1994. The book provides a broad collection of articles on the behavior of proteins at interfaces, most of which derive from recently completed investigations focusing on topics of current interest. The major themes include molecular mechanisms, competitive adsorption, conformation of proteins at interfaces, surface chemistry effects, protein effects on cell interactions, and the behavior of proteins at fluid–fluid interfaces.

This book can provide a sound introduction for those new to the field but will have its greatest impact as a convenient way for experienced investigators to broaden their understanding of the behavior of proteins at interfaces.

The introduction by Leo Vroman, surely the expert's expert on protein interfacial interactions in "outrageously complex protein mixtures", relates specifically to blood-material interactions, phenomena that have motivated many of the researchers who study proteins at interfaces and whose work is described in the volume. However, its message can be transposed and applied to any complex biofluid. The introduction indicates the complex nature of these interactions and warns us, lest we become prematurely smug, that there is still a long way to go in achieving anything resembling a full understanding.

This valuable book is ideal for those who wish to get a brief background in protein science as well as for those who seek a further grounding in the subject.

Th. Fischer (Leipzig)

Perkolationstheorie, eine Einführung
by Dietrich Stauffer and Amnon Aharony
Verlag Chemie Weinheim 1995.

On 202 pages with 41 figures the authors give an introduction to percolation theory. The book is suitable for a broad readership, elementary mathematical or physical previous knowledge is presupposed. It will however primarily be of interest for students in Physics, Chemistry and related disciplines. The edition reviewed here is the German translation of the second English edition (translated by Thomas Filk).

Percolation theory investigates phenomena of penetration, interlinking, and cluster formation in non-ordered heterogeneous systems. Its application extends over a widespread area in different fields of scientific and practical importance, for example the study of self-organized criticality and phase transitions. It provides models e.g. for the description of polymerization processes, the structure of polymeres and elastic networks, of properties of diluted magnets and high temperature supraconductors, of droplet condensation, diffusion on fractal geometries und many other topics. These and more examples are shortly introduced to the reader.

The book does not claim to be a monograph of the complex field of percolation theory. It was rather designed as a textbook and it treats the basic principles of percolation theory starting from elementary examples. It is written clearly and intelligibly, often in a relaxed and entertaining style. For more comprehensive and more detailed questions the readership is referred to carefully selected lists of review articles and special literature appended to each chapter.

The reader is supplied with the relevant definitions and technical terms and he finds a comprehensive collection of formula, where less stress is layed on accurate mathematical derivation but on plausibility and intelligibility. Particular emphasis is devoted to the description of critical phenomena and phase transitions. Apart from comprehensible analytical derivations as for example for Bethe lattices, which represent simple example systems in the study of percolation, also numerical approaches for the determination of characteristic coefficients are described. For selected geometries, a collection of known parameters is given in tabular form.

The authors endeavour to embed their presentations into wider context of related topics and applications. When describing the fractal properties of percolation clusters they go into the basics of fractal geometries and provide the reader with a demonstration of simple model fractals. One finds an introduction to the application of renormalization groups. The authors also present numerical recipies (Monte–Carlo-analyses) for the study of percolation properties.

For illustration of the mathematical calculus, a number of applications of percolation theory are described. The meaning of characteristic quantities in percolation systems is demonstrated by means of practical examples. In addition to the examples listed above, we learn about Random walks on percolation clusters, conductivity measurements in percolation systems and reconnaissance of oil fields.

A collection of exercises is appended which encourages the reader to carry out accompanying training steps. This collection comprises relatively simple but also quite complex and ambitious problems, analytical derivations as well as pure numerical programming tasks, all designed to stimulate further and more detailed occupation with the topic. Unfortunately no hints or references to literature are enclosed which makes it difficult for the reader to test his solutions and partially dampens the motivation to tackle the exercise tasks.

It would be highly desirable if in further editions a number of misprints or mistakes in translation could be carefully avoided. In summary, the book is recommended for readers interested in the general topic of percolation theory and its applications, who do not bring along special previous knowledge and who look for an introductory lecture and quick access to basic principles.

R. Stannarius (Leipzig)

Surface Analysis with STM and AFM
S.N. Magonov, M.-H. Whangbo 1996.
323 pages, 232 figures, 3 tables. VCH Verlagsgesellschaft mbH, Weinheim.
Price: DM 198,-.

The invention of the Scanning Tunneling Microscope (STM) in 1981 started a new epoch in microscopy: real-space atomic-sized three-dimensional visualization of surfaces. Based on this measuring concept a family of so-called scanning probe techniques has since been developed using different types of physical and chemical interactions for detection of surface properties on nanometer or even subnanometer scale under any environmental conditions. Beside TM especially the Atomic Force Microscopy (AFM) became a routine method in surface characterization.

In "Surface Analysis with STM and AFM" S.N. Magonov and M.-H. Whangbo give an introduction into the physical concepts of both methods. However, as mentioned in the subtitle "Experimental and Theoretical Aspects of Image Analysis", their primary goal is the interpretation of the resulting images on the basis of theoretical calculations, is to point out problems with the convolution of the different interactions between tip and sample in the measuring process.

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The 14 chapters can be divided into three subject areas. At first physical phenomena and fundamentals relevant to STM and AFM as well as the operating principles and instrumentation of the scanning microscopes are described. There are also useful hints for image optimation. The second part concerns with theoretical aspects of image analysis, density plot calculations, and accommodation of tip-sample force interactions. To explain several essential problems in atomic-scale imaging, simulations are tested on experimental results for some suitable layered inorganic compounds. One chapter is dedicated to the STM detection of point defects. The third part deals with experimental STM and AFM images of a variety of different materials such as organic conducting salts, organic adsorbates at solid/liquid interfaces, self-assembling structures, and polymers and their interpretation. Here, Magonov and Whangbo present various examples from their own current research.

Numerous schemes and diagrams as well as excellent original STM/AFM images illustrate the test. A detailed reference list is given at the end of each chapter.

The book is made as of a piece and it will be a very recommendable tool for newcomers as well as for researchers already familiar with the subject.

U.-C. Boehnke (Leipzig)

Multidimensional Spectroscopy of Polymers
M.W. Urban and Th. Provder, ACS Symposium Series 598, American Chemical Society, Washington, DC 1995, ISBN 0-8412-3262-8, 604 pages, hardback.

When two or more analytical techniques are tied together a new level of understanding is achieved, resulting in a synergistic outcome of an experiment. If one considers a simple experiment in which spectroscopic analysis is performed as a function of time, concentration or other additive properties, the output will be multidimensional and provide an additional wealth of information. In this volume several aspects on multidimensional spectroscopic analysis are presented with special emphasis on Fourier transform IR and Raman, NMR and fluorescence spectroscopies. In a fourth chapter multidisciplinary approaches are given with combined studies of Fourier transform IR and Fluorescences spectroscopy for instance. The book describes in an especially nice way the state of the art in multidimensional spectroscopy of polymers. It contains a rich bibliography. It is highly recommended for both specialist and newcomers in this strongly expanding field of research.

F. Kremer (Leipzig)

The Vitreous State
Thermodynamics, Structure, Rheology, and Crystallization
I. Gutzow, J. Schmelzer
Springer Verlag, Berlin, Heidelberg, New York, ISBN 3-540-59087-0, 468 pages, hardback, DM 198,00, öS 1.445,40, sFr 187,00.

This book tries to summarize the experimental evidence and the different theoretical approaches – structural, thermodynamic and those of statistical physics – connected with the formation, the kinetic stability, and with the general nature of glasses as a particular physical state. Special emphasis is taken on the process of nucleation and crystallization of glass-forming systems and on methods of preventing or catalyzing crystallization in vitrifying liquids. Applying methods such as classical thermodynamics, the thermodynamics of irreversible processes, statistical physics, structural modelling and rheology of liquids, theory of phase formation and crystal growth the authors try to demonstrate that at least in principle any substance can exist in the vitreous state.

The book is well written and has a rich bibliography of more than 900 references. Unfortunately it has no subject index. This considerably decreases its value as a compendium for non-specialist.

F. Kremer (Leipzig)

Spectroscopy with Polarized Light
Solute alignment by Photoselection, in Liquid Crystals, Polymers, and Membranes by Josef Michl, Erik W. Thulstrup VCH Publishers, Inc., 1986, 1995, 573 pp., ISBN 0-89573-346-3 VCH Publishers, Inc. (Hardcover); ISBN 1-56081-910-3 VCH Publishers, Inc. (Softcover).

This is the second edition of the book which became one of the most popular textbooks for reference in the papers dealing with characterization of molecular orientation using optical spectroscopy. Although the text was written from the point of view of someone characterizing orientation of small molecules in uniaxial solvents, the fundamentals of the book can be easily applied to liquid crystals, polymers and biological materials.

After describing the background given in the first two chapters, the authors review practically all of the methods for monitoring the molecular orientation such as UV-VIS, IR spectroscopy, photoluminiscence, photodichroism, two-phonon absorption, ordinary and resonant Raman scattering. The following four chapters are dealing with quantitative aspects for interpretation of the spectral measurements by these methods in terms of transition moments. The authors discuss in detail the ways of calculating of first and second order orientation factors both from static and from modulation spectra. The information concerning the molecular biaxiality is also derived from those spectra. The limitations of the different approximate methods are critically reviewed. The last chapter cites many examples for applications (from small molecules to biopolymers) which are selected from electric and vibrational spectroscopy. All used mathematics is summarized in the appendix.

It should be pointed out that this book is entirely related to the simple case of uniaxial orientation so that the complex types orientations are out of the scope.

The book is written at a level suitable for graduate students and researchers. It can be used as a reference book for everybody who wants to use optical methods to characterize molecular orientation.

S. Shilov (Leipzig)

Langmuir–Blodgett films an introduction by Michael C. Petty, 234 pages, 175 figures, 13 tables, Cambridge University Press 1996, ISBN 0 521 41396 6 (hardback), ISBN 0 521 42450 X (paperback).

The book provides a multidisciplinary introduction to the subject of Langmuir–Blodgett films. These films are the focus of intense current worldwide interest, as the ability to deposit organic films of nanometre thicknesses has many implications in materials science, and in the development of new electronic and opto-electronic devices.

Beginning with the application of simple thermodynamics to the common bulk phases of matter, the book outlines the nature of the phases associated with floating monolayer films. The Langmuir–Blodgett deposition process itself is described in some detail and contrasted with other thin film techniques. Monolayer-forming materials and the structural, electrical and optical properties of Langmuir–Blodgett films are discussed separately.

Each chapter is comprehensive, easy to understand and generously illustrated. Appendices are provided for the reader wishing to delve deeper into the physics and chemistry background.

Th. Fischer (Leipzig)

Fundamentals of adhesion and interfaces, edited by D.S. Rimai, L.P. DeMejo and K.L. Mittal, -Utrecht: VSP (1995), ISBN 90-6764-197-9 with 296 pages and more than hundred figures, covers the lectures given at the three-day symposium entitled *fundamentals of adhesion and interfaces* in Chicago, August

1993 of the American Chemical society. The book provides a broad collection of articles on the adhesion behavior at interfaces, most of which derive from recently completed investigations focusing on topics of current interest. The major themes include mechanics of adhesion, surface roughness effects, adhesion of charged particles, grafted polymers at interfaces, interfacial failure effects, wetting hysteresis phenomena, influence of cracks at interfaces, friction forces and molecular modeling of interfacial energies.

This book is a hard cover reprint of the Journal of Adhesion Science and Technology, volume 8, no 11 (1994) and volume 9, no 8 (1995) which can provide a sound introduction for those new to the field but will have its greatest impact as a convenient way for experienced investigators to broaden their understanding of the behavior of adhesion at interfaces.

This valuable book is ideal for those who wish to get a brief background in adhesion science as well as for those who seek a further grounding in the subject.

Th. Fischer (Leipzig)

Polymer Surface Modification: Relevance to Adhesion
edited by K.L. Mittal, X + 547 pages, 318 figures, 79 tables, 735 references. VSP, Utrecht (1996) Hardcover 177,-DM/121 USS ISBN 90-6764-201-0.

The book embodies the proceedings of the International Symposium on Polymer Surface Modification: Relevance to Adhesion (Las Vegas, 1993). The articles were previously published in four special issues and one regular issue of the *Journal of Adhesion Science and Technology* in 1994/95.

In spite of their desirable bulk properties, the use of polymer materials is often hindered by their low surface energy and their hydrophobic character. Several techniques of surface modification have been developed to improve wetting and adhesion properties without altering the bulk ones.

The 34 research contributions are thematically divided into four parts as followed: Plasma Surface Modification Techniques, Laser Surface Modification Techniques, Other/Micellaneous Surface Modification Techniques, and General Papers. Beside the dominating plasma and laser treatment applied to a variety of polymers, surface modification techniques used include corona and glow discharge, flame, UV, ozone, UV/ozone exposure, (photo)chemical treatment, (photo)chemical grafting, or surface modification by microorganisms. The resulting surfaces are characterized by different methods such as XPS, IR-Spectroscopy, XAES, contact angle measurement, inverse gas chromatography, optical microscopy, SEM, AFM etc.. Problems of the metal–polymer adhesion or the ageing of surface treated polymers are discussed as well. Numerous diagrams, schemes, images, and tables illustrate the text.

In short, the book gives a state of the art overview to surface modification of polymers, a subject of cardinal interest for many practical applications.

U.-C. Boehnke (Leipzig)