Porous Media

W. Ehlers and J. Bluhm (eds.)
Springer-Verlag, (2002), 459 pp.,
ISBN: 3-540-43763-0
$119 / £70 / €99.95

Subtitled *Theory, Experiments, and Numerical Applications*, this volume reports on recent scientific developments in the theory of porous media. The collection of articles move from basic concepts in continuum mechanics in porous and multiphasic materials to experimental and numerical applications. This includes both fundamental approaches and various applications to engineering problems.

High-temperature Solid Oxide Fuel Cells: Fundamentals, Design and Applications

S. C. Singhal and K. Kendall (eds.)
Elsevier Advanced Technology, (2002), 512 pp.,
ISBN: 1-85617-387-9
$206 / €206

With the growing interest in fuel cells as a sustainable source of energy, this new book provides comprehensive and practical information on solid oxide fuel cells. It is intended to be a single source of information for designers, manufacturers, and end-users, as well as researchers and membrane manufacturers. Chapters that describe each part of the fuel cell are followed by sections on design, modeling, and testing of fuel cells and stacks.

Nanostructured Materials

Heinrich Hoffmann, *et al.* (eds.)
Springer, (2002), 210 pp., ISBN: 3-211-83779-5
$129 / €116

This collection of articles gives an overview of the state-of-the-art in research on nanostructured materials. The articles summarize work presented at a European Cooperation in the Fields of Scientific and Technical Research (COST) workshop in 2001. The synthesis, properties, and characterization of nanostructured materials are discussed for systems such as magnetic and ferroelectric nanoparticles, nanoparticles in biological systems, nanocomposites, and thin films.

Expert

Graduate

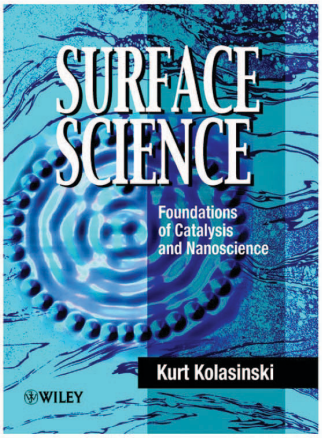
Undergraduate

Science on the surface

In what is destined to be a classic of its time, Kurt Kolasinski communicates all the interest and excitement of surface science, says **John T. Yates, Jr**.

This is a truly readable and enjoyable book that can be recommended to advanced undergraduates and beginning graduate students in chemistry, physics, engineering, and materials science. While it contains up to date research information about surface chemistry and physics, it is also highly inspiring in a broader way for students and faculty alike, capturing the essence of the frontier of the field while also laying out the foundations. I was so impressed upon first reading that I purchased a copy for each of my 20 students and post-docs within two weeks.

The book begins with a well-written introduction, which broadly splashes some of the brightest paint one can use to describe why the field of surface science is interesting and important – heterogeneous catalysis and semiconductor surface chemistry being the two main historical motivations for the field's development.



Surface structure forms a major foundation for the field, and the book continues with an illuminating chapter on atomic and electronic structure, as well as a brief account of the vibrational properties of the bulk and surface of solids. A summary of some of the most important experimental techniques used in surface science research follows, in some cases illustrated with data from the field. In contrast to many surface science books, the emphasis on experimental techniques is downplayed somewhat, as Kolasinski focuses instead on concepts – a mark of a rich book.

The interaction of molecules with surfaces is fundamental to surface chemistry and Kolasinski neatly combines physisorption, chemisorption, and surface dynamics in a readable manner for any chemist or physicist. I particularly liked his discussion of the electronic factors at work as a molecule bonds to a surface. This treatment nicely leads into the thermodynamics and kinetics of surface processes – where concepts of Langmuirian and precursor-mediated adsorption are discussed and compared. One can see the historical flavor of the book here with a replotting of Langmuir's classic study of Cs adsorption on W from 1933. In addition, the use of temperature-programmed desorption is fully described, including some experimental and simulated data to illustrate the importance of this kinetic technique.

The book ends with two chapters on the complexity of processes on surfaces, namely heterogeneous catalysis and etching, followed by thin film growth and epitaxy. Here we are treated to the relationships between surface science and the applied world, and many important intellectual connections are established. These include the famous work of Stoltze and Norskov, establishing the relation between thermodynamic and kinetic parameters measured on single crystal surfaces with the performance of an ammonia synthesis plant. Also discussed is the three-way automotive catalyst and its connection to environmental cleanup and the consumption of Pt group metals. Catalytic promoters and poisons are discussed, operating on catalyst surfaces or in Si etching. The final chapter deals with thin film growth, both as Langmuir-Blodgett self-assembled organic films and as epitaxial inorganic films.

What are the essential characteristics of this important book? First, it is up to date and accurate; second, it is written interestingly, with copious well-executed illustrations. But most importantly for the reader is Kolasinski's communication of the excitement of the field, which is found between each of the pages of this book. Even the problems are exciting for the reader. The problems are often taken from the research literature and honed into an interesting concept for the student as the problem is solved. I highly recommend this wonderful book to all. It will stand as a classic of its time, and will serve countless students of surface chemistry and physics. Its low price as a paperback edition makes it eminently suitable for everyone.

Kurt W. Kolasinski
Surface Science: Foundations of Catalysis and Nanoscience (2002),
John Wiley & Sons, 326 pp., ISBN: 0-471-49245-0
$45 / £27.50 / €45.40

John T. Yates, Jr. is R. K. Mellon Professor and director of the Surface Science Center at the University of Pittsburgh.