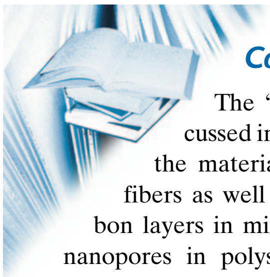
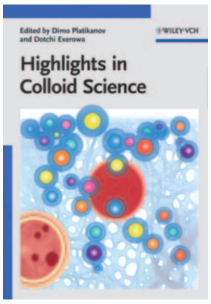


Highlights in Colloid Science



Highlights in Colloid Science
Edited by D. Platikanov and D. Exerowa. Wiley-VCH, Weinheim 2009. 306 pp., hardcover, 129.00 €.—ISBN 978-3527320370

The "Colloid Highlights" discussed in this monograph concern the material chemistry of cellulose fibers as well as fluorinated hydrocarbon layers in mixed systems, macro- and nanopores in polystyrene, waves in water arising from alternating electric fields, low-melting nanoparticles in pores, and the theory of hemimicelles on water surfaces. All of these subjects and a few others are competently discussed, references cover the time period from 1980 to 2007, and one learns a lot of interesting details about fascinating surface interactions. Many of these phenomena can be found in daily life in one way or another. Sixteen very diverse chapters cover two fields—Colloid Chemistry and Physical Methods and Theory; a brief glimpse here may relay the colorful overall impression.

The ordering and fixation of heterogenous particles (e.g. clay, titania) in papermaking can be programmed by a process called heteroflocculation, which is described by T. G. M. van de Ven in the first article. The cellulose fibers are negatively charged by rapid stretching, cationic polymer "spots" are attached, and anionic particles "fill" the empty spaces. A second article on cellulose by P. Stenius and M. Andresen explains technical problems with chemically derivatized fibers.

The uptake and release of active species into and from microgel particles is covered by M. Bradley, P. Davies, and B. Vincent. The authors describe microgel particles made from cross-linked poly(*N*-isocaprylamide) and coated with proteins, which recognize specific cell surfaces and shrink at the "fever temperature" of 40 °C to release pharmaceuticals or attached proteins exclusively to cancer cells or other abnormal tissues. The interaction between hydrocarbons and fluorinated analogues—as discussed by E. G. Shchukin, E. A. Amelina, and A. M. Parfenova—leads to multilayers, which are much more stable than pure CH_2 or CHF assemblies and form flat droplets. This stability of fluorinated systems is useful in matrices for complex reaction systems.

B. Lindman et al. point out that DNA–detergent interactions are strongest when the detergents have already formed micelles. Manipulation of DNA by surfactants should therefore always involve application of highly charged aggregates. The resulting DNA reservoirs and gels change form and size drastically with small changes of environmental conditions. The role of cubosomes as delivery vehicles is discussed by N. Garti et al. Nonviscous solutions are obtained from amphiphilic block polymers containing nanometer-sized, water-filled pores suitable for transport and release of proteins. A similar topic is covered in the article by C. Solans and J. Esquena, who describe highly concentrated emulsions as reaction media.

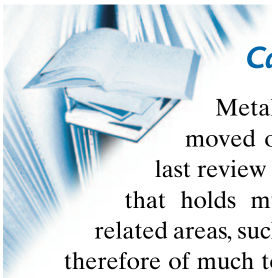
R. W. O'Brien, J. K. Beattie, and R. J. Hunter introduce electroacoustic spectroscopy as a method for particle characterization. Alternating electric fields move charged particles in solution, thus generating ultrasonic pressure waves. The force of these waves moves the particles, not the electric field. J. Lyklema and A. B. Jodar-Reyes report on charged hemimicelles on the water surface, which have been modeled only (self-consistent field calculations), because of their instability.

Further articles give details of studies on foam, emulsion, and wetting films (D. Exerowa, D. Platikanov), stable colloidal liquids (G. J. Fleer, R. Tuinier), melting/freezing phase transitions in confined systems (L. Boinovich, A. Emelyanenko), and the deposition of colloidal particles at heterogenous surfaces (Z. Adamczyk, J. Barbasz, M. Nattich). In the latter article, the authors point out that the "jamming coverage" of spherical sites is only fast with small particles.

The article by S. Less et al. describes water-in-oil emulsions stabilized by wettable silica nanoparticles. With increasing particle concentration, the asphaltene disappears from the water–oil interface and is attached to the particles. This process destabilizes the system and leads to phase separation. The book closes with articles on the impact of micellar kinetics on interfacial properties (R. Miller et al.) and on the modeling of the aggregation of colloids (P. Somasundaram, V. Runkana).

The book is recommended to every chemist or physicist who works with complex systems in aqueous media. She/he will learn about new aspects of the interactions in the micro and nano "underwater worlds" and the quantification of experimental observations.

Jürgen-Hinrich Fuhrhop
Institut für Chemie
Freie Universität Berlin



Metal Oxide Catalysis

Metal oxide catalysis has moved on considerably since the last review of the area. This is a field that holds much promise in energy-related areas, such as photocatalysis, and is therefore of much topical interest.

This collection of individual chapters by experts in the field aims to provide an overview of the current state of the area. Just to be clear, the focus is on catalysis by metal oxide materials. Catalysis involving metals supported on oxides, such as Au on TiO_2, is not part of the remit. Nor are single-crystal studies of "model" catalysts. This still leaves plenty of scope, as evidenced by the 866 pages in two volumes.

The first of the two volumes deals with the major techniques used to study powder catalysis. This follows a brief preface by the editors David Jackson and Justin Hargreaves, who set the scene. I would have preferred a longer introductory chapter covering the broader historical context and some details of the industrial context. After saying that, the historical context is in fact provided in individual chapters.

The techniques covered are electron paramagnetic resonance (EPR), UV/Vis and near-infrared spectroscopies, infrared spectroscopy, resonance Raman spectroscopy, solid-state NMR spectroscopy, photoelectron spectroscopy, X-ray absorption spectroscopy, transmission electron microscopy, and thermal analysis (e.g., DTA, DSC). There is also a chapter on periodic electronic structure calculations.

These chapters are written in a didactic fashion, making this volume suitable as a reference book for a master's degree course in this area. The style of presentation varies from chapter to chapter to some degree. For example, some chapters concentrate on explaining the techniques through the use of examples. But the Wiley format tends to pull it all together. X-ray and neutron diffraction techniques would have been possible additions, but they (at least XRD) tend to be covered by texts aimed at first-degree (BSc) level.

Overall, Volume 1 provides an excellent introduction to the main techniques used to characterize polycrystalline materials and their reactivity. It would also be a valuable reference work for a practitioner in the field, since it provides enough technical details for most purposes.

Volume 2 deals with 11 different areas of oxide catalysis: oxidation reactions over supported vanadia; vanadium phosphate catalysts; catalysis by uranium oxides; heteropolyoxometalate catalysts for partial oxidation; dehydrogenation of alkanes catalyzed by vanadium and chromium oxides; catalysis by highly dispersed metal oxides; the preparation and catalytic action of superacidic metal oxides; titanium silicalite as a catalyst for oxidation, hydroxylation, etc.; oxide photocatalysts; mixed oxide ammoxidation catalysis of hydrocarbons; and finally, the use of materials such as alkali metal oxides as base catalysts. Although the coverage is not completely comprehensive, nor does it claim to be, Volume 2 covers a considerable chunk of metal oxide catalysis in some detail. Just one quibble: I would have liked some discussion of catalysis by metal oxide nanotubes as an emerging topic.

The variations in length, style, and content from chapter to chapter is more evident in Volume 2. This is as might be expected, considering the different concepts that are included. Authors of some chapters clearly place more emphasis on materials aspects and physical processes. As examples, in the chapter on uranium oxides there are a few pages on the phase diagram of the oxides, while in Chapter 19, which deals with photocatalysis, the physical processes involved, such as band-gap excitation, are covered. In contrast, Chapter 18, on titanium silicalite, is very much a description of the chemistry. There is rather little cross-referencing to Volume 1 when the uses of these techniques are discussed, although it is fairly easy to find the appropriate chapter in Volume 1.

As in Volume 1, the level of presentation is excellent. The technical level is also comparable to that of Volume 1. The editors are to be congratulated on putting together two comprehensive volumes of material on metal oxide catalysis that will remain useful as master-degree and more general reference texts for several years.

Geoff Thornton
University College London (UK)

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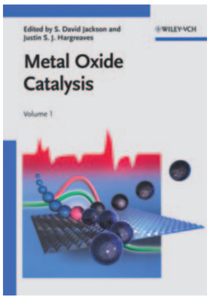

Edited by S. David Jackson and Justin S. J. Hargreaves

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Volume 1

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