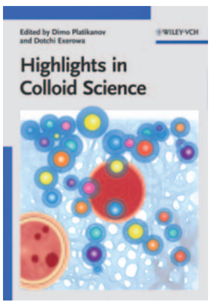
Highlights in Colloid Science

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.



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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.

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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