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BOOK REVIEW

SURFACE AND INTERFACIAL TENSION
Measurement, Theory and Applications

Surfactant Science Series, Vol. 119
Edited by Stanley Hartland
Marcel Dekker, Inc., New York, Basel, 2004
III-X + 619 pages
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Interfacial phenomena are of essential importance in the evaluation of the properties of colloid systems, because it is hardly possible to interpret the behavior of liquid droplets, wetting processes, surface cleaning, *etc*., without a precise knowledge of the thermodynamic properties of gas/liquid and liquid/liquid and interfaces. A prerequisite to this is the knowledge of surface tension and its exact measurement. Important practical aspects are the qualification of solid/liquid interfacial interactions by contact angle measurements, the knowledge of capillary phenomena for studies on nanoporous materials in industrial and pharmacotechnological applications. This book gives an ample review of both academic research and practical applications in this field.

Chapter 1 (Drainage and collapse in standing foams) discusses several practical uses of foams and their structure (the geometry of foam structures). The authors introduce a theoretical model of film drainage and enumerate the components of disjoining pressure. It is pointed out that film rupture depends on how disjoining pressure changes with film thickness. Film stability is characterized by the same function. Examples are given for the calculation of the components of disjoining pressure, for the role of these forces in colloid stability and how they can be controlled through the composition and electrolyte concentration of the medium.

The next chapter deals with the stability of aqueous foams. Methods of foam stability control are described, stressing the importance of foam coalescence in industrial applications. Static and dynamic defoaming methods, which can be used as ASTM standards for the measurement of foam stability, are presented. Examples are mentioned for methods to measure foam lifetime, bubble size and size distribution and dynamic surface tension.

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In the subsection on foamability and foam stability, the reader is acquainted with the Gibbs-Marangoni Effect, which declares the existence of a "time-dependent restoring force in thin films". Thus, this effect determines the possibilities of foam formation and elimination. Modern physical methods for thin film measurement techniques and surface viscosity determinations are described. Several methods for film destabilization are also described: for example, some additives cause film rupture and can therefore be used for defoaming.

The next chapter describes the relationships of wetting at the solid-liquid interface, with special regard to an analysis of Young's Law and Antonow's rule. Special equations are given for the determination of contact angles, which can be used for describing the shape of droplets. For the calculation of contact angles, the author of the chapter also takes into consideration the role of line tension, which makes this contribution the most up-to-date description of wetting presently available.

The next subject is bubble motion in liquids. Various simulations for the description of bubble motion are presented.

The importance of capillarity in liquid flow in porous media is demonstrated in the next chapter. The reader is introduced to the basic physical relationships of liquid flow governed by capillarity and to their various industrial applications, *e.g.* quantitative relationships of capillary effects in composites prepared by melting and in fibrous materials and fabrics. Capillary pressure and its role in composite preparation are treated in a separate section.

The subject of the next chapter is the behavior of aqueous solutions of surfactants in quartz capillaries. Examples are given for the theory and practice of capillary flow not only in liquid-solid but also in liquid-liquid (solution-oil) systems. For adequately describing these phenomena, understanding the role of the adsorption of surfactants of various structures is extremely important. In the case of solid-liquid interfacial interactions in porous systems, penetration of surfactants into the pores and the hydrophilic/hydrophobic character of the pore surfaces play an important role.

Examples for measurements methods of contact angles and surface tension are introduced in the next chapter, covering a great variety of techniques. Methods for contact angle measurement in fibers, fiber assemblies, fabrics and textiles are also exemplified.

A thermodynamically sound description of bubble formation and detachment follows in the next chapter. Heteronucleation, including examples for bubble adhesion to surfaces and nucleation on the liquid-liquid interface are also touched upon.

The next chapter discusses the relationship of the free energy of curved surfaces and Helfrich curvature on a thermodynamic basis. The authors use Laplace's equation for the description of curved surfaces and the calculation of

surface free energy. Finally, as an example for these useful relationships, the reader is presented with a thermodynamic description of the formation and elimination of microemulsions and vesicles, processes of basic importance in pharmacotechnology and the cosmetic industry.

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