

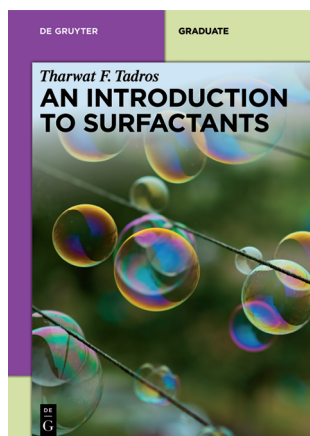
Review of *An Introduction to Surfactants*

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Introduction to Surfactants by Tharwat F. Tadros. De Gruyter: Berlin, 2014. 224 pp. ISBN 978-3110312126 (paperback). \$98.00.

Few types of chemical species, if any, touch our daily lives in as many ways as surfactants. Their use spans road and building construction, cleaning agents, agrochemicals, pharmaceuticals, and home health care products to name but a few. Tharwat F. Tadros's *An Introduction to Surfactants*, published by De Gruyter, shows promise as a very readable overview for those entering the field or those needing knowledge of the subject to supplement their own area of expertise. Organized into 11 chapters, the book offers fundamental and practical information as a proposed graduate text, but also as a resource clearly intended for formulation chemists. Chapters largely deal with a range of surfactant properties and uses to give the individual a working knowledge of the field. Further organization of chapters into sections and subsections will facilitate quick reference to details when desired. In addition, key words and phrases have been highlighted in blue to help the beginner achieve mastery of important terms. Equations, generally without derivations, are used to support underlying concepts. A positive feature of the book relates to Tadros's efforts to help the reader understand qualitatively the chemical rationale underlying observed effects due to surfactant structure, system composition, and conditions.



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After a brief opening chapter, structural classes of surfactants, also called amphiphiles, are described in Chapter 2 with the general broad categories of ionic, nonionic, and zwitterionic/amphoterics species. One finds generic and/or specific examples for these groups with chemical formulas or structures given. Other sections on specialty surfactants such as fluorosurfactants, polymeric surfactants, and biosurfactants provide the reader with exposure to the rich diversity available in the

selection of amphiphiles for various purposes. In this regard, Tadros draws on a wealth of knowledge to suggest specific uses for certain types of surfactants. For example, he notes that amphotericics with little eye or skin irritation work well in shampoos, while some phospholipids have been used as lung surfactants to address respiratory distress syndrome in premature neonates. Chapter 3 covers various types of aggregate structures and so-called phases. The emphasis is on micelles, including the kinetics and thermodynamics of their formation at the critical micelle concentration (cmc). In addition, this chapter examines micellization in mixed surfactant systems with graphs illustrating the change of cmc with composition. While effectively presenting these topics overall, the material on Israelachvili's packing parameter falls short in explaining how molecular architecture of the surfactant as captured by this dimensionless group can influence the nature of aggregates. In Chapter 4, sections are devoted to adsorption at the air–liquid, liquid–liquid, and liquid–solid interfaces. Fundamental equations such as the Gibbs adsorption equation, Henry's law, and common isotherms appear in the context of conditions suited to their use. Experimental techniques for determining interfacial tensions with the Wilhelmy plate, pendant drop, du Noüy ring, and spinning drop systems are described, although the presentation may leave the novice with the impression that these methods apply only to the liquid–liquid interface.

Remaining Chapters 5–11 focus on application of surfactants for purposes ranging from foams, wetting, and dispersions to the preparation of emulsions, nanoemulsions, and microemulsions. The approach to these topics is geared toward meeting the needs of one working in the lab with surfactants. Here the author's efforts stand out as in three of these chapters (5, 8, and 9) he gives readers a practical introduction to processes and procedures for forming the various types of emulsions. The emphasis is on the hydrophilic–lipophilic balance (HLB) and phase inversion temperature (PIT) methods. He gives insights to the selection of surfactants and co-surfactants for oil-in-water and water-in-oil emulsions based on HLB number. Since energy must be supplied to create emulsions and nanoemulsions, several equipment options for mixing are presented, along with results obtained for each. Tadros also makes clear the importance of characterization techniques in preparing optimal emulsions. Graphs show how a sharp minimum of interfacial tension with temperature can be used to find the phase inversion point, while the use of conductivity measurements for the same purpose is also described. Many problems can be encountered during emulsion preparation and storage. Among these are creaming/sedimen-

tation, Ostwald ripening, flocculation, and coalescence. Each one of these concerns is described in brief, distinct sections along with ideas for addressing them.

Considerable overlap exists between Chapters 6 and 10, which examine dispersion of solids and wetting, respectively. Relevant topics contained in these chapters include contact angle, Young's equation, work of adhesion, and the spreading coefficient. Chapter 7 presents fundamental concepts on foams, their stabilization, and ways to prevent their formation or eliminate them once formed. Without equations or figures, the final Chapter 11 is markedly different in character from the other chapters. It covers a wide range of subjects mostly organized as applications toward specific products while briefly examining some key concepts such as solubilization and detergency.

An Introduction to Surfactants succeeds in offering a concise overview with practical knowledge and it might serve well as an ancillary textbook for a course on colloid and surface science. In its present form though, it would be difficult to recommend this book as a primary text. There are simply too many production errors, giving one the impression it was rushed to print. One finds repetitive writing in a few places and errors occur in spelling, exponentiation, capitalization and names (e.g., Raynolds for Reynolds). There are equations with terms undefined or defined well after their introduction, others with the omission of equal signs, and equations that are not dimensionally consistent. While there is much to offer in the way of classical literature in the field, most references are over 20 years old. As such, the book could be improved with incorporation of material on more current topics, such as perhaps dispersion of nanotubes, molecular modeling of surfactant adsorption, surfactant-based separations, and application of the HLD method to formulation of microemulsions.

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