Interfacial Phenomena - Equilibrium and Dynamic Effects (2nd Edition)

By Clarence A Miller and P Neogi, 2nd ed, Taylor and Francis, London, 2008, 501 pp.

This updated version remains as relevant and valuable now as did the first edition, when it appeared as volume 17 in the successful surfactant science series. The text splits neatly into two halves. The first covers the phenomenology, simple chemistry and thermodynamics of interfaces, with particular reference to colloidal dispersions and micellar surfactants; the second covers the motion of interfaces and transport phenomena associated with these interfaces. It is clearly intended for graduate students in chemical engineering and others entering the field. It is a book to study systematically as an introduction to the subject, and not to dip into and use as a reference text. Many crucial matters are introduced only in the problems set out at the end of each chapter rather than in the main text. Fortunately, the index covers the problems, as well as the main text, and so a reader soon realizes the importance of these problems in the structure of the book.

Throughout the book the authors have tried to keep a subtle balance between simple verbal explanations of important phenomena, quantitative factual information about them, and formal mathematical representations of current theories and models. As an interested reader, I would have preferred a greater separation of these three approaches, within a given section or even within a given chapter. They are, however, to be complimented on presenting all three.

I was disappointed that although there is reference (inevitably) to molecules in the text, the entire approach of the authors is essentially that of continuum mechanics and thermodynamics; almost no reference is made to statistical mechanics, let alone quantum mechanics. That would have been a reasonable assessment of the engineering importance of the latter two approaches to modeling of the liquid state (both in the bulk and at its boundaries) in 1985 when the first edition of this book appeared; it is less justified now that direct computational simulations (using quantum, molecular or Brownian dynamics) are becoming increasingly practicable and precise. These calculations give hope that many constitutive (thermodynamic) material functions may be obtained from knowledge of molecular force fields, for both the bulk phase and interfaces. Furthermore, transient and deformational (in a continuum sense) behavior can similarly be simulated, so nonequilibrium (dissipative) processes and constitutive functions can in principle also be obtained. The authors are not alone in restricting themselves to one approach; it is almost inevitable given the complexities of, and rapidly growing literature relating to, each of the two separate points of view.

From a pragmatic engineering point of view, a continuum approach is essential. What is equally clear is that separate models are often necessary (and certainly suitable) for processes taking place on different length and time scales. Chapter 7 on dynamic interfaces contains many examples of this. This demanding situation is summed up by the authors in their introduction on page 385: "In spite of many attempts, no general strategy has emerged for solving the equations of fluid mechanics to obtain the shapes of fluid interfaces." One of the most challenging aspects is discussed in section 10, on dynamic contact lines, the dynamics of which involve both fluid/fluid and fluid/solid interfaces, as well as the contact line. The situation can be further complicated by the presence of additional thin or ultrathin films on the solid surface, which itself can be rough and inhomogeneous on a range of scales from the molecular to the continuum. These scaling difficulties were probably appreciated and understood by J W Gibbs, when thermodynamics was in its infancy. They have, however, been neglected until recently: we are now able to investigate them much more thoroughly than in the past because of major advances in both computational power and experimental devices to probe nanoscale phenomena. An important question, is, therefore, whether relevant ideas and techniques should be introduced much earlier into chemical engineering courses, taking precedence over much of the detailed development of specialized solutions to model equations, or over systematic cataloguing of current technologies.

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AiChE Journal, Vol. 54, 3032 (2008)

DOI 10.1002/aic.11631
Published online September 24, 2008 in Wiley InterScience (www. interscience.wiley.com).

Encyclopedic Dictionary of Named Processes in Chemical Technology, Third Edition

By Alan E. Comyns, CRC Press, Boca Raton, FL, 2007, 422 pp. $149.95.

This book is the third edition of a dictionary of named processes in the chemical industry, the first edition having been published in 1992, and the second edition in 1999. As Dr. Comyns points out in the Introduction, it is difficult to describe the limits of the "chemical industry," which encompasses a wide variety of technological processes from production of basic chemicals to sewage treatment and fabrication of electronic devices. Thus, the book is wide-ranging in the kinds of processes it describes. The author has deliberately excluded processes involved in industrial food chemistry.

As a chemist, I note that this book does not, nor was it intended to, include names or descriptions of chemical reactions such as the Canizzaro reaction or the Heck reaction, which is often the focus of work in academic laboratories, and which may also be the basis of production of fine chemicals. While that omission may limit its use by academic chemists, the book nevertheless serves this group well because knowledge of industrial processes is essential to allow one to communicate with engineers and scientists who work in the chemical industry. Dictionary is a good name for the book because the language of the industrial chemist or engineer is often very different from that of the academic chemical laboratory.

The book is organized in alphabetical sections from A to Z. The entries tend to be short definitions. Some definitions are so short as to be useable only by persons intimately involved in the particular process. Most definitions are general in some manner, and, therefore, require the reader to search further for specific information. Several devices are used to help the reader delve into the information more completely. One extremely useful device is the presence of references directly after a definition, which conveniently points the reader to patents and articles that expand on the book's short definition. In addition, cross-referencing among entries is done by having an asterisk placed next to words or phrases defined elsewhere in the book. A reader can easily move through the book, comparing different phrases, or follow up with more information. Yet another device that helps the reader is the appendix, which gives an alphabetical listing of chemical products, with the names of processes involving that material. The appendix allows one to connect products to one or several processes in a relatively rapid, straightforward manner.

This is not a book that I would read in bed. However, it provides a great deal of useful information on names of industrial chemical processes, and I am happy to have it on the shelf next to my desk for those times when I want to brush up on the nature of a process, the name of which I have heard but the nature of which may not be part of my knowledge base.

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AIChE Journal, Vol. 54, 3032 (2008)

DOI 10.1002/aic.11638
Published online September 24, 2008 in Wiley InterScience (www.interscience.wiley.com).