very amusing. For example, in Chapter 1 he says, "*Key Point*. All rules have exceptions and all exceptions may become common practice (Dickey, 1991)." Did Dave Dickey really say this in a private communication; if so, did he expect to be quoted!

Chapter 2 is called Power and Flow (52 pages). In it, some ten pages are devoted to "Rheology" and this important topic is also discussed in Chapter 5, Pitfalls in Process Translation and the Use of Analogies (38 pages). In Chapter 5, Process Myths, one finds, "Another myth is the importance of rheology. For the most part, rheology becomes fairly unimportant. Exceptions to this statement are well known since, in special cases, rheology controls everything," and again "Another process myth involves slurries as shear thinning materials. Slurries are generally shear thickening." The first statement seems to me to be less than helpful and the second, I think those people mentioned in the Preface would agree, is wrong!

Chapters 3 and 4 are Processes and Process Objectives (94 pages) and Process Translation (63 pages), respectively. One spoof (?) from Chapter 4 on Process Mixing Similarities, "A giraffe and an elephant are similar in that both have four limbs, one neck, one trunk (*sic*) and one head; however, don't make exact comparisons" sets the flavor. Also in Chapter 4, on two occasions, power P is related to torque T_o and speed N, once by the equation $P = T_o/N$ and once by $T_o = P/N$. Both are wrong; $P = 2\Pi N T_o$. The equation "$k_L a \alpha (N^3D^2)^{0.74}(V_s)^{0.28}$" is given in Chapter 5. Perhaps tongue in cheek, this equation is taken to imply that $k_L a$ should increase by $D^{1.58}$ on scaleup, that is, by 38 for a linear scaleup of 10! What it really tells one, of course, is that at an equal specific energy dissipation rate and superficial gas velocity, V_s, $k_L a$ does not change with scale!

As a spoof, the book works and I hope readers get as much fun out of it as Gary must have done writing it. My worry is that many people won't see it that way. In the past, mixing, for reasons which we need not go into here, has often been considered less than academically respectable in spite of its enormous importance across the whole spectrum of the process industries. It is seldom taught adequately in universities and few of the "big names" have chosen to work in the area. I feel that, in recent years, the image has begun to change, partly through groups like the North American Mixing Forum (NAMF) which have brought academics and industrialists together, and partly through better quality research. This book will not improve the image of the subject or help change negative attitudes.

Let me finish with one more quote, "*Key Point*: One can assume that similar looking equipment will behave similarly. Exceptions to this rule will occur from time to time but not for the reasons one expects. Surprises occur." They certainly do!

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Macrotransport Processes

By H. Brenner and D. A. Edwards, Butterworth-Heinemann, Stoneham, MA, 1993, 714 pp., $75.

This is a welcome addition to a relatively sparse literature and offers a mathematically rigorous procedure to connect the microstructure to the macroscopic phenomenology in a variety of transport processes. The term *macrotransport processes* describes the fact that transport processes are modeled macroscopically, but by emphasizing the macroscopic character of the modeling equations it also implies that an inherently complex, heterogeneous system is studied, the microscopic structure of which is suitably abstracted. Indeed, the only difference between the macroscopic transport equations and those developed for a molecularly homogeneous medium more than 30 years ago (Bird et al., 1960, *Transport Phenomena*, Wiley) is in the fact that transport parameters are not directly associated with the molecular structure, but indirectly through the "mesoscopic" structure of the complex heterogeneous medium under study. It is exactly this association that forms the field of study of this treatise.

As transport phenomena involving complex media are encountered more and more frequently in chemical engineering applications, it becomes increasingly advantageous to replace laborious and time-consuming experimental procedures necessary to determine macroscopic transport parameters with *a-priori* theoretical calculations. Unfortunately most of the existing approaches are either highly approximate or specific to particular applications only. This textbook, however, presents a systematic procedure to obtain this information, which can be also used for a considerably wide variety of applications.

The general problem addressed here is the connection between the phenomenological diffusivity and the apparent velocity corresponding to the macroscopic description of an advective-diffusive transport process of a solute in a complex medium to the medium's inherent microstructure. It focuses on the generalized advection-dispersion problem where a Brownian tracer (typically but not necessarily limited to a material particle) is advected and simultaneously dispersed as it is introduced within a complex medium in flow motion. The defining characteristic of all applications is the presence of two different scales of coordinates, global and local, with the distinction between the two accomplished by the requirement that, within the time scale of interest, all local space has had the opportunity to be sampled by the tracer due to its random, Brownian motion. This permits focus on the global, not on the combined local plus global, description. However, variations taking place in the local space still affect the results in the global space (in particular they determine the macroscopic transport coefficients) and the transition from the microscopic to the macroscopic description needs to be performed in a careful fashion. This is accomplished in the book in a highly systematical and a mathematical manner. The followed procedure can also be visualized as an abstraction (or projection) from an accurate, but highly complicated and multidimensional, microscopic description to a more easily solvable and lower-dimensional macroscopic one.

This coarse-graining approach is necessary when several length and/or time scales are involved in a phenomenon. This is a common characteristic of a variety of flow applications, most of which are considered in this textbook ranging from chromatography to suspensions rheology and flow through porous media. Therefore, it is becoming increasingly important to systematically perform this "coarse graining" procedure and determine from "first principles" of phenomena involving complex media. To achieve this task rigorously in a variety of applications, even at the expense of relatively complicated mathematics, it is worthwhile to get familiar with it.

In the preface an analogy of the macrotransport processes to the Darcy's law description of flows through porous media is made. The key principles that are elaborated in the following chapters in great detail are also mentioned: the mean solute velocity, the Taylor/Aris dispersivity, and the effective volumetric reaction rate. Among the applications mentioned here we need to underline is that of the chromatographic separation. The key message that this textbook brings is eloquently emphasized in the preface: a systematic approach to derive macrotransport coefficients in terms of the solution of a corresponding microscale boundary-value problem. The authors consider it "one of the more physically self-consistent coarse graining theories existing in the transport phenomena literature." From a theoretical perspective, it is noted with respect to the system's macrotransport description that "(it) possesses a similar dual *Lagrangian/Eulerian* interpretation as that of the system's microtransport description." This duality is valid at the macro as well as at the micro level.

The book has three parts. The first (Chapters 1–9) deals with material dispersion theory, the second (Chapters 10 and 11) with nonmaterial (energy and momentum) dispersion theory, and the last one, the smallest (Chapters 12 and 13), with a short description of the foundations of macrotransport processes. Several applications are examined in detail throughout the book, starting in the first chapter with the original Taylor-Aris dispersion theory of a solute in the flow through a tube (Taylor, 1953, *Proc. Roy. Soc.*, **A219**, 186; Aris, 1956, *Proc. Roy. Soc.*, **A235**, 67) and progressively moving to more complicated ones in the subsequent chapters. Chapter 1 also provides an informal, nonmathematical overview of the key principles and primary applications of the macrotransport theory offering a good, clear description of the phenomena. After a brief literature survey, the key concepts/prerequisites for the theory are laid down. Both material and nonmaterial dispersion theory (exemplified through the discussion of momentum dispersion in porous media and suspensions) is introduced here. The Taylor dispersion emerges as the key concept resulting from the influence of external fields, rotation, velocity sampling due to differences in charges, sizes, shapes, and so on.

In all cases, the material is presented in a highly organized manner. First, the layout of the chapters is established according to criteria based on the principal characteristics of the problems under investigation. Prominent among those is the distinction between continuous (for example, capillary tube) and discontinuous (for example, porous media) applications discussed in Chapters 2–3 and 4, respectively. Other criteria include transport at the material interface separating two material media (Chapter 5), time periodicity in the flow (Chapter 6), the presence of coupling between the local- and global-space driving forces as realized by the hydrodynamic interaction between a particle and the wall or another particle in suspensions (Chapter 7), the presence of particle sources or sinks caused, for example, by chemical reactions (Chapter 8), and the presence of spatial periodicity (Chapter 9). This systematic presentation serves a dual role: it demonstrates potential applications more clearly and helps direct the reader to the appropriate location. In principle, after reading the introductory material in Chapters 1–4, the reader shall be able to read any other chapter in any order as needed.

In each chapter, the relevant system of partial differential equations, enabling the calculation of the macroscopic transport coefficients, is first systematically developed in the abstract local-global coordinate formalism for the specific class of macrotransport processes considered. The formal spatial axial-moment formulation originally developed by Aris (above citation) suitably modified is used for that purpose. The resulting equations are neatly summarized and the involved generic abstract variables tabulated for the benefit of the reader who is interested in solving the equations for a particular application rather than in their detailed mathematical derivation. This reader is especially further facilitated by meticulously going through the remainder of the chapter which deals with specific example applications where the before-mentioned theory is applied. Numerous figures, boxes, and each application equivalence table connecting the generic and the specific to that application variables further facilitate the understanding of the material. In this respect, the exercises at the end of every chapter become an integral part of the book directing and simultaneously helping the reader better understand the involved mathematical manipulations.

In conclusion, despite the mathematical complexity of the subject which is the biggest drawback of a more widespread use of the proposed theory, the authors, obviously very much aware of this fact, tried their best to overcome it through the exposition style (figures, boxes, and summaries), the organization of the material, a gradual introduction of the most difficult concepts, and many examples and exercises. They have admirably succeeded in this effort, and I therefore wholeheartedly recommend this textbook to anyone who is interested in transport phenomena in heterogeneous media.

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Surface and Colloid Science

Edited by Egon Matijevic, Vol. 15, Plenum, New York, 1993, 276 pp.

Surfactant technology is built on a vast body of scientific literature. The prospect of mastering even a part of that literature challenges the process engineer, industrial formulator, and academic researcher alike. Various textbooks introduce fundamental concepts and flag key papers, but forego excessive depth. Review chapters, such as those in the *Surface and Colloid Science* series, provide comprehensive coverage of more specialized topics.

Earlier volumes in this series included a number of chapters related to surfactants scattered among reviews of other areas. Volume 15 differs from its antecedents because it focuses primarily on one topic: association of surfactants or block copolymers as micelles. By and large, the six chapters in the volume avoid the well-covered topic of surfactant association in water; instead, they treat a variety of subjects of emerging importance in chemical technology. Three chapters provide extended introductions as well as comprehensive reviews; these should interest a wide audience. The other three chapters have more narrow foci and are highly recommended for specialists.

The first chapter, "Micelles of Block and Graft Copolymers in Solution" by Z. Tuzar and P. Kratochvil, stands out in its depth and breadth of coverage. The authors restrict their scope to association of diblock and triblock copolymers in dilute solutions, summarizing a large body of literature and formulating useful generalizations. After a brief review of characterization techniques, the chapter describes experimental work (primarily using radiation scattering) to determine micellar structure. A parallel section on theoretical models of copolymer micelles omits details but provides key predictions for association num-