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Book Reviews

Process Development - Physiochemical Concepts. By J. H. Atherton and Keith Carpenter Oxford Science: Oxford, UK. 1999. 89 pp. £6.99. ISBN 0-19-850372-5.

The Oxford Chemistry Primer series, designed to produce a series of undergraduate texts at affordable prices, has been a great success. This book is volume 79 in the series of slim paperbacks and continues the high standard. There has been one earlier volume on process development: *Fine Chemicals from Grams to Kilogram*, but there is no overlap between the two works. In fact the volume by Atherton and Carpenter covers areas which have been little explored in the literature, outside the publication of the two authors. Atherton is a chemist, now working for Avecia, recently hired off from Zeneca, whereas Carpenter, the chemical engineer, still works for Zeneca. In essence the area covered is physical organic chemistry which is the essential bridge between organic chemistry and chemical engineering and is so vital for an understanding of process development and scale-up. What a pity it is not more widely studied in universities!

The chapters in the book illustrate the breadth of discussion: scope of process development, strategy for process development, pre-reaction equilibria, competing reactions, mixing effects, equlibria in multiphase systems, dispersion and mass transfer in multiphase systems, mass transfer and reaction in 2-phase systems, product isolation and work-up, and finally scale-up.

The coverage of these chapters is in a descriptive manner with sufficient kinetic data and graphical representations to make the data meaningful. Chemists and chemical engineers will learn a lot from reading the text, particularly the useful examples which are presented.

Main criticisms are that terms (e.g., shear stress) are introduced without explanation on occasions and examples are not always taken through to the conclusion, to see how the understanding of the physicochemical principles helps in the process improvement (e.g., halogen exchange reaction). The index is poor—having read the book I wanted to go back to find particular topics (accumulation, halogen exchange, shear stress, etc.) but none of these are listed.

But these are minor criticisms—the volume is excellent value for money and well-produced. Everyone can afford to buy a personal copy as well as one for the library!

Trevor Laird

Editor

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Green Chemistry. By Paul T. Anastas and John C. Warner. Oxford University Press: Oxford. 2000. Paperback. 135 pp. £14.99. ISBN 0-19-850698-9.

This slim volume is a paperback version of the 1998 hardback of the same name. The objective appears to be to introduce green chemistry concepts to chemists or chemistry students, to try to influence the way they practice chemistry. The theory and principles expounded in the text are sound enough, and few chemists would disagree with the aim to reduce pollution by appropriate design of chemicals and particularly by the design of environmentally friendly processes. The "practice" section of the book is woefully inadequate, however, reflecting the authors' lack of experience of industrial chemistry in the real world. For example, there is no real discussion of the importance for green chemistry of introducing convergence into a synthetic sequence to reduce the overall weight of starting materials, reagents, solvents, etc. to produce a kilogram of end product.

The second omission is on the principles which should be used for work up and product isolation to minimise the number of effluent streams generated and the quantity of each stream. Many problems are often generated by mixing organic solvents with water—and vice versa—whereas a solvent-based work-up (with subsequent solvent recovery) with no aqueous quench would be environmentally more attractive.

The view expressed in the book is that solvents are always bad. However, in many processes where water is used as a solvent, the product needs to be extracted into an organic solvent to purify it, generating an aqueous effluent containing solvent. A purely solvent-based process, with solvent recovery and good environmental practice to reduce VOCs—which is an industrial requirement in most countries these days—would actually generate little effluent.

There is a naivety in the book that indicates that the authors are unaware of how industry has changed in the past few years. This is reflected in the reference list—there are 39 references, and 10 of these refer to papers in a publication from the Office of Pollution Prevention and Toxics. These references are mostly to U.S.-based research and do not reflect work done in Europe by, for example, the groups at York or Delft, or to important work being carried out in industry (e.g., Hoechst) which has been published in the last year.

This is an opportunity missed—to educate young chemists in university and industry. The work will not appeal to either and cannot be recommended.

T. Laird

Editor

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Practical Process Research and Development. By N. G. Anderson. Academic Press: New York. 2000. 264 pp. £56.50, $89. ISBN 0-120-594-757.

The increasing profile of Process Research and Development has resulted in a significant expansion in the number of books available on the subject, some better than others. This new volume by Dr. Andersen ranks with the very best on the subject covering almost all aspects of Process Research and Development and Scale Up in an informative and readable manner. The printers have not done the book any favours, however, as figures and tables referred to in the text often appear in the next section of script and usually on a different page.

The book is, not surprisingly, biased towards the Pharmaceutical industry, as the vast majority of the examples quoted are from this area, but the principles are equally applicable to the Fine Chemical, Agrochemical, and related industries. Each topic is covered in detail with plenty of examples and references, but the chapter on work-up seems a bit thin, considering how important this aspect is. In addition the section on the Statistical Design of Experiments is rather limited, although there are several texts available which cover this topic in detail. Having read the book, I found the ability to retrieve information is limited by the poor subject index.

On the plus side the many "Tips" given throughout the book are practical and informative and should be mandatory reading for all synthetic organic chemists, including those in research and discovery. The book emphasises the need to think about exactly what is happening and what chemical entities are present at any particular point in the reaction to obtain the best yield and purity of product—referred to as the "snapshot" approach.

Overall, the complaints are minor and in no way detract from the overall quality of the book, which could well become a standard text on the subject. Indeed, it is my recommendation that Process Chemistry departments throughout the industry buy two copies, one for themselves and one to help educate their colleagues in research/discovery. Many of the topics covered and the tips given in the book could also be of great use to anyone organising organic chemistry practical courses for students.

Perhaps the highest praise one can give this book is to say that Foreword by Barry Sharpless raises very high expectations (as a good Foreword should) and the book meets and at times exceeds those expectations.

Will Watson
Scientific Update, Wyvern Cottage, High Street, Mayfield, East Sussex, TN20 6AE, U.K.

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Bretherick's Handbook of Reactive Chemical Hazards, 6th ed. (2 vols.). Edited by P. G. Urben, compiled by M. J. Pitt. Butterworth-Heinmann: Oxford, UK. 1999. 2532 pp. £175.00. ISBN 0-7506-3605-x. CD ROM (Reactive Chemical Hazards Database) ISBN 0-7506-434-20.

Bretherick's Handbook of Reactive Chemical Hazards contains an up-to-date selection of documented information on chemical reaction hazards, providing an unparalleled database for research students, practising chemists, safety officers, and others concerned with the safe handling and use of reactive chemicals. Thus, the two volumes gather together a huge quantity of chemical hazard and incompatibility information, making it an essential piece of "equipment" for every chemistry lab. It enables any chemist designing a new reaction or modifying a known reaction to check that he or she is not repeating a mistake or hazardous incident that has already been "published". Quite simply, every home or at least every lab (or plant) should have one or at the very least have access to a copy on site.

In the latest edition of "Bretherick" (the 6th edition) the already comprehensive list of chemicals and associated hazards has been increased and updated (to the end of 1998). Thus, the new edition includes data on about 200 new chemical compounds in Part 1, and 30 new groupings in part2. This means that in total nearly 5000 compounds and 650 groups are listed. Although the physical size of the 6th edition is almost identical to the 5th edition, there is still the same quality and attention to detail which has characterised all of the editions. The format is essentially the same as that of previous editions: individual compounds are listed in chemical formula order in volume 1, and certain compounds or elements are listed in groups in volume 2 (essentially an alternative form of index for volume 1) making it easy to "upgrade" to the new edition.

The handbook is also available on CD-ROM, and a trial version comes free with the hard copy. The electronic version is easy to use with plenty of shortcuts to related topics, making it significantly easier to use than the hard copy, with the added advantage that it can be networked. Anyone handling reactive chemicals that does not have easy access to a copy of "Bretherick" is missing out on an essential source of safety information. If chemists only buy one book on safety then it should be "Bretherick".

Will Watson

Scientific Update, Wyvern Cottage, High Street, Mayfield, East Sussex, TN20 6AE, U.K.

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