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Book Reviews *

Clean Technology for the Manufacture of Speciality Chemicals. Edited by W. Hoyle and M. Lancaster. Royal Society of Chemistry: London, UK. 2001. 104 pp. £49.50. ISBN 0-85404-885-5.

Clean or Green Technology is no longer a new concept; thus, in a sense this book would have had more impact a few years ago. Nevertheless, although the overall message is not new, there are still some interesting approaches and suggestions on the subject of waste reduction described in the book. Almost inevitably the book covers a wide mix of subjects and approaches varying from a detailed study of potential nitration catalysts to a chemical engineering overview of different types of reactors. The result is something of a mish-mash providing something for everyone, but not necessarily an awful lot for anyone. There are one or two articles on developments, such as Process Intensification, that look to the future, but I would have preferred to see more suggestions or pointers as to where the industry should be looking for the next generation(s) of technology. At £49.50 the book is not expensive, but then again it is only 104 pages long. It does provide a good introduction for people new to industry and the subject in general, but those on a limited budget may want to consider carefully before buying. Overall, I would recommend this book, but with some reservations.

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Transition Metal Reagents and Catalysts: Innovations in Organic Synthesis. By J. Tsuji. Wiley: Chichester. 2000. 492 pp. Price £135. ISBN 0-471-63498-0.

This volume is an expanded and updated English version of a book with a similar title in Japanese, written by Professor Tsuji in 1997. It is very comprehensive with a phenomenal number of examples of reactions listed, and therefore, no one will read this without being inspired to do new chemistry with transition metals. Unusually the field of homogeneous catalysis has developed from industrial roots, namely the process for carbonylation of alkynes and alkenes, production of polymers by the Ziegler−Natta processes, and the Wacker process for acetaldehyde. These processes were all developed in the 1930s to 1950s without an understanding of their mechanism. It was only after much academic work that these—and other—reactions are now fully understood. It is appropriate, therefore that the first chapter in the book is devoted to these industrial processes. However, this short introductory chapter is where industrial process chemistry ends; the rest of the book covers vast amounts of literature, but not from an industrial perspective. Thus, turnover number and frequency, catalyst separation and removal from the product, toxicity of the catalysts and reagents are hardly mentioned. Having said this, the coverage of the literature is comprehensive, and the book is easy to read and to quickly browse to find examples of interest. Each of the 11 chapters, which are classified by type of reaction so that catalysts and reagents can easily be compared, is well referenced, with some chapters having over 200 references. Most of the references are to 1990s chemistry with coverage up to 1998 and occasionally 1999. This may be a limitation in some topics, such as olefin metathesis, which have moved on fast in the last 3 years.

Nevertheless, despite these minor criticisms this is a book that should be in every organic chemist's library. It is a book for the nonspecialist, as well as the specialist, and industrial chemists will find it useful in helping to find simple but cost-effective synthetic routes to target molecules from olefins, acetylenes, and other simple molecules.

OP010107M

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Crystallisation, 4th Edition. By J. W. Mullin. 2001. Butterworth Heinemann: Oxford, UK. 600 pp. £75.00. ISBN 075-064-833-3.

Forty years after the 1st edition, the 4th and much expanded edition of Mullin's *Crystallisation* has appeared. Professor Mullin is now semi-retired—well, he is Professor Emeritus—but obviously has time to spend on completely revising his important work. New sections have been added on control and separation of polymorphs, on crystallisation of enantiomers by resolution, micro- and macromixing and the use of computer fluid dynamics, seeding and secondary nucleation in batch crystallisation processes, upstream and downstream processing requirements, and computer-aided molecular design and its use in crystal habit modification.

The text fulfils expectations and is up to the high standard of the previous editions. For organic chemists the emphasis on inorganic salts and aqueous chemistry detracts from its usefulness. One wonders how much one can extrapolate from aqueous ionic solutions to covalent molecules in hydrocarbons!

The new sections are only partially successful. The section on polymorphs is not very practical, and recent techniques such as Raman monitoring of suspensions are not mentioned. Key references on the analysis of polymorphs such as Threlfall's paper in *The Analyst* (**1995**, *120*, 2435) are

*Unsigned book reviews are by the Editor.

omitted. Similarly, later references to Collet's work on resolution are not mentioned.

The section on seeding would have benefited from inclusion of results from Beckmann's recent paper in *Org. Process Res. Dev.* (**2000**, *4*, 372) on seeding strategies in batch crystallisation. The issue of quality of seeds or whether solid or a slurry of seeds should be used is not discussed (nor are GMP issues regarding final drug crystallisation).

Despite these criticisms, this is still an excellent book, which I enjoyed reading. For the organic chemist the mathematics may be a little oppressive, but the text is otherwise very readable and full of useful theory and practical advice. This book is a must-buy for every library and good value at 600 pages for £75.

OP0101005

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Clean Synthesis Using Porous Inorganic Solid Catalysts and Supported Reagents. By J. H. Clark and C. N. Rhodes. The Royal Society of Chemistry: Cambridge. 2000. 117 pp. £55. ISBN: 0-85404-526-0.

This is the latest in the Royal Society of Chemistry's Clean Technology Monographs (series editor, J. H. Clark). This small volume contains four chapters; Introduction, Zeolite Materials, Clay Materials, and finally, Supported Reagents, the longest chapter. It is a useful summary of the field, but industrial organic chemists will find that they need to refer back to the original references to get much detail on individual reactions. Thus, many reaction equations give only the structure of the starting material and product without detailed conditions, yields, conversions, or byproducts being mentioned. Turnover number (TON) and turnover frequency (TOF) of catalysts are hardly mentioned. It is therefore difficult to get a true picture of the current state of the art in the area, particularly from a practical industrial viewpoint. For example, in the discussion of the Henry reaction (reaction of nitro alkenes with aldehydes to give nitro alcohols) catalysed by clays it is difficult to judge—since no yield or conditions are given—whether this is important. It might be very useful, since it avoids generation of explosive nitromethane salts when base catalysis is used. But this is not discussed.

In summary, the book provides a useful summary of the state of the art up to 1999, from an academic, rather than an industrial perspective. Industrial chemists will find the discussions on chemical processes rather superficial, with economics, availability of catalyst, reproducibility of catalysts, robustness of processes, and so forth, only briefly touched on. The volume would have benefited from a concluding chapter summarising the current position and what needs to be done—both in academia and industry to encourage some of the interesting observations, mentioned in the text, to be developed further by industry.

OP0100910

10.1021/op0100910

Asymmetric Oxidation Reactions. Edited by T. Katsuki. Oxford University Press: Oxford. 2001. 244 pp. Price £75. ISBN 0-19-850201.

This is the latest volume in the outstanding "Practical Approach in Chemistry" series, and the new book continues the very high standard set by previous volumes. The editor, Professor Katsuki, has assembled a list of coauthors which includes Sharpless, Kagan, Evans, Davis, Bolm, and many others, including industrial chemists. The topics covered include C−H oxidation, epoxidation of olefins, epoxidation using peroxides, dihydroxylation, aminohydroxylation, aziridination, hydroxylation of enolates and enols, Baeyer−Villager oxidations, oxidation of heteroatoms (S, Se, N), and biocatalytic oxidations. For those not familiar with the series, a brief review of the methodology is followed by detailed practical procedures including—safety precautions, so important when dealing with oxidations. However, for the process chemist, there will still be too many work-ups including stripping to dryness without checking that all peroxides are removed.

The coverage of the literature is, in chapters, only to 1997, and thus important new work in the area is not referenced. This means that recent methodologies of, for example, Aggarwal are not covered.

Two indexes are provided, a reaction index and a reagent index, both of which are rather short. No author index is provided.

In conclusion, Professor Katsuki has provided an important practical review of the current state of asymmetric oxidation with a selection of experimental protocols. This should allow practising chemists to choose the best procedure for a particular transformation.

OP020002Z

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Encyclopedic Dictionary of Named Processes in Chemical Technology, 2nd edition. By Alan E. Comyns. CRC Press: Boca Raton. 1999. 303 pp. £66.99. ISBN 0-8493-1205-1.

The dictionary contains brief details and references to over 1000 named processes in the chemical industry. Since the previous edition in 1992, an additional 244 processes have been added, including 72 in the commodity chemicals arena, 37 in petroleum refining, 26 for treating gaseous effluents, 21 for sewage treatment, 13 for polymerisations, and 75 for other processes including waste treatment, enzyme processes, desulphurisation, and so forth. There is little of interest for the chemist and chemical engineer working in the fine chemicals industry, the focus being mainly on commodity

chemicals' manufacture. It was surprising to find so little on metathesis in the dictionary, but other than this, the coverage is very comprehensive. Each process is only covered in a few lines (with no formulae), so that the reader may need to consult the references to get more details of catalyst concentration, turnover number, economics, reaction conditions, and so forth. Thus, the listing for Monsanto's L-DOPA process is given only two lines, the structure of L-DOPA is not provided, nor is the starting material named. All one is told is that the catalyst is a chiral diphosphine—rhodium complex. Surely some more details could be provided—and references—for a process for which Knowles recently won the Nobel prize, and for which excellent academic work has helped to understand the catalytic cycle. Similarly, the Monsanto acetic acid process (MeOH and CO) only warrants two lines, although key references are provided in this case.

Since the processes are covered in alphabetical order with lots of cross-references, there is no index, but a useful appendix entitled "key to products" allows one to identify all processes listed for a particular chemical.

In conclusion, this is not a useful volume for the chemist/chemical engineer working with fine chemicals, but for those in the commodity chemical industry, it will be a good port of call for named processes.

OP020003R

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The Diels−Alder Reaction: Selected Practical Methods. By F. Fringuelli and A. Taticchi. Wiley: Chichester. 2002. 340 pp. £130. ISBN 0-471-80343-X.

This volume is a follow-up to the authors' previous book, *Dienes in the Diels−Alder Reaction*, published in 1990. Chapters include the thermal D−A reaction, Lewis-acid-catalyzed D−A reactions, reactions facilitated by special physical and chemical methods (e.g., solid phase, ultrasound, microwave, light, micelles, biocatalytic, etc.), high-pressure D−A reactions, and D−A reactions in unconventional reaction media (water, nonaqueous polar systems such as lithium perchlorate−diethyl ether, ionic liquids, microemulsions, and supercritical fluids). Each chapter contains a well-written summary of the latest literature (to 2001) with lots of examples, followed by a list of graphically abstracted D−A reactions to show selected applications. The final chapter lists reviews, monographs, books, symposia proceedings which have appeared since 1990 and contains a useful list of key words to help readers locate a particular item.

This is an excellent compilation and will be the first port of call for anyone wishing to carry out D−A reactions (or their hetero-equivalents which are also well-covered in the text). Industrial readers will probably dispute the use of the word "practical" in the title, since there are no experimental procedures listed. The text, however, does discuss applications, for example in the section on D−A reactions in aqueous media, in a practical style. It would have been interesting to have a chapter on industrial uses of the D−A and related reactions, which must number hundreds of examples.

It was disappointing to find that the asymmetric D−A reaction was not given a chapter on its own—coverage is restricted to 10 pages with isolated examples mentioned elsewhere. Thus, important issues such as solvent effects on enantioselectivity are not mentioned.

Despite this minor criticism, this is a very useful, well-written volume, and the data is easy to assess. The price of £130, however, seems excessive and will discourage purchase by individuals. Since the authors have published a number of reviews in the open literature on related topics, individuals may prefer to obtain copies of these rather than such an expensive book.

OP020004J

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Basic Organic Stereochemistry. By E. L. Eliel, S. H. Wilen, and M. P. Doyle. Wiley-Interscience; New York. 2001. 702 pp. Price £59.50 (Paperback). ISBN 0-471-37499-7.

This book is derived from the much larger *Stereochemistry of Carbon Compounds* coauthored by two of the above authors with L. H. Mander, published in 1994 (1267 pages) and is intended as a teaching aid for undergraduate courses and a refresher for graduates in academia and industry.

It covers structure and properties with a great deal on spectroscopy, symmetry, conformation, chiroptical analysis, and so forth. The chapter of most practical value to process chemists in industry is Chapter 7, Separation of Stereoisomers, Resolution, and Racemisation. This is an excellent summary with over 400 references beginning with separation of isomers by crystallisation, and continuing with phase diagrams, conglomerates and preferential crystallisation, second-order transformations, resolving agents and resolution methods, purification of enantiomers (including chromatography), kinetic resolution, and finally racemisation.

This is an extremely comprehensive summary of the topic, the only criticism being that the references are a little out of date with few references after 1994. Thus, important topics such as "Dutch resolution" and SMB methods for separation of enantiomers on large scale are not mentioned. Perhaps this was one of the chapters written before the death of Sam Wilen, who was an expert in this field.

In general, the references in each chapter refer to the older literature (which is acknowledged in the preface), with recent review articles cited for further reading.

In summary, this is an excellent, well-written textbook that should be in every library.

OP010106U

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Stirring: Theory and Practice. Marko Zlokarnik.Wiley−VCH: Weinheim. 2001. 362 pp. £95. ISBN 3-527-29996-3.

Two short quotations show the wide scope of this monograph—"Stirring is one of the unifying processes which form part of the mechanical unit operations in process technology" (Preface) and "If the liquid component predominates in the mixture of substances to be mixed, the mixing operation is named stirring, and a stirrer (an impeller) is used as the mixing device. The following five stirring operations can be distinguished:

Homogenization i.e., equalization of concentration and temperature differences

Intensification of heat transfer between a liquid and a heat transfer surface

Suspension (and possibly dissolution) of a solid in a liquid or slurry formation

Dispersion (or emulsification) of two immiscible liquids

Dispersion (or sparging) of a gas in a liquid (gas−liquid contacting)" (Chapter 1).

The eight chapters bear the following titles:

1. Stirring general
2. Stirrer power
3. Homogenization
4. Gas−liquid contacting
5. Suspension of solids in liquids (S/L System)
6. Dispersion in L/L Systems
7. Intensification of heat transfer by stirring
8. Mixing and stirring in pipes.

These topics will be immediately recognizable to those chemical engineers who are familiar with the subject of liquid mixing. What, however, will probably be less familiar are the many correlations of engineering quantities originating from measurements made in German industry and universities, which are clearly presented in this monograph. Details of original publications are included in the literature section, which encompasses 732 citations. The author, who has had decades of experience with Bayer in Leverkusen and in technical universities, participated in some of these investigations. He also extended the principal method used here to correlate experimental results, namely, dimensional analysis.

This reviewer notes a few misprints, and so forth. The name Zwietering is correctly spelled on pp 40 and 355, but pp 41, 42 and 207 give other spellings. The literature citations for heat transfer correlations in Table 7.1 (p 276) contain errors. Chapter 4.9 is entitled Chemisorption, which is inappropriate as a description of gas absorption with simultaneous chemical reaction.

Chemists are likely to find this work too technical and to miss close connections to chemistry. Three chapters deal with the physical processes involved in creating, maintaining, and characterising dispersions, but the text hardly shows how this material is linked to reaction rates and selectivity when carrying out two-phase reactions and to the means of achieving a required chemical result. Similarly topics where mixing impacts on chemical reaction engineering (e.g., the role of the residence time distribution in continuous processing) are not included.

This monograph can be strongly recomended to chemical engineers who have experience in liquid mixing. They will find much original, stimulating, and useful information, which is well structured. The presentation of the text, tables, figures, and equations is of a high standard.

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