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Book Reviews *

Synthetic Applications of 1,3-Dipolar Cycloaddition Chemistry toward Heterocycles and Natural Products. Edited by Albert Padwa and William H. Pearson. Wiley: New York, Chichester. 2002. Hardcover: $425. 952 pp. ISBN 0-471-38726-6. Paperback: $99.95. 952 pp. ISBN 0-471-28061-5.

This excellent book covers in 12 chapters some of the more important 1,3-dipolar cycloaddition reactions for the formation of heterocyclic ring systems.

In the first chapter Martin and Jones discuss the uses of nitrones in synthesis. This includes important background information leading to a thorough coverage of nitrone cycloaddition chemistry from the synthesis of histrionicotoxin to recent applications in combinatorial chemistry.

In the second chapter Denmark and Cottell cover the chemistry of nitronates and their use in cycloaddition chemistry. An in-depth coverage of silyl nitronate and alkyl nitronate chemistry is described, and the application in natural product synthesis is highlighted.

In the third chapter on azomethine ylid chemistry, Harwood and Vickers discuss the methods available for generating azomethine ylids and their use in cycloaddition chemistry. Catalysts in the synthesis of homochiral heterocyclic compounds are described, and this chapter provides an excellent review for the reader.

Chapter four by McMills and Wright is concerned with the chemistry of carbonyl ylids. This chapter covers inter- and intramolecular processes leading to a range of interesting heterocyclic structures including Padwa's spectacular route to dehydrovindorosin and the Hashimoto/Merck/Hodgson routes to zaragozic acid. Both metallocarbenoid and nonmetallocarbenoid processes are well described.

Mloston and Heimgartner examine the chemistry of thiocarbonyl ylids in chapter five. Application of this carbonyl ylid chemistry to the preparation of thiophane ring systems is described together with many inter- and intramolecular cycloaddition examples leading to the preparation of mixed heterocyclic rings.

Chapter six by Jäger and Colinas covers the preparation and reactions of nitrile oxides. Although the literature presented on nitrile oxide preparation, is incomplete the following discussion of the applications of nitrile oxides in synthesis is very good and provides an excellent overview for the reader.

The chemistry of nitrile ylids is the subject of chapter seven by Sharp. Generation of the nitrile ylid and cycloaddition reactions are well reviewed, providing the reader with a sound understanding of the area.

Cycloaddition reactions of diazoalkanes are covered in chapter eight by Maas. Very interesting and unusual cycloaddition reactions are presented, including additions to phosphalkynes. Inter- and intramolecular examples are cited, providing a useful review of the area.

Sha and Mohankrishnan review the cycloaddition chemistry of azides in chapter nine. The chemistry covered includes inter- and intramolcular cycloaddition reactions of azides and nitrenes. Alkenyl aziridines generated as intermediates serve to form pyrrolidines as in the cited synthesis of gephyrotoxin.

Gribble presents an excellent account of the use of mesoionic compounds in cycloaddition chemistry in chapter ten. Routes to small heterocyclic rings are beautifully described, and the reactions are extended to the preparation of larger ring systems, including lysergic acid.

The effect of external reagents on [3 + 2] cycloaddition reactions is examined by Kanemasa in chapter 11. A very useful review is provided here, and kinetic and stereochemical data are evaluated.

In the final chapter, Gothelf and Jørgensen review asymmetric [3 + 2] cycloaddition sequences. This is a very valuable review.

In my opinion the book overall is a must for any practicing organic chemist.

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OP034095B

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Organic Chemistry Principles and Industrial Practice. By M. A. Green and H. A. Wittcoff. Wiley VCH: Weinheim. 2003. 341 pp. 39.90 Euro (soft cover). ISBN 3-527-30289-1.

What an excellent read! The book, intended for organic chemistry students, is in the style of the first books on organic chemistry by Isaac Asimov which impressed me as a teenager in the 1960s. It makes the discovery of new chemicals and processes seem exciting and emphasises the importance of academic understanding in the development of the chemical industry.

In the context of this book, the chemical industry means petro-chemicals and polymers, i.e., the bulk chemical industry. The fine chemicals industry, agrochemicals, colour chemicals, and pharmaceuticals are rarely mentioned. Chapters cover each of the basic industrial polymers in turn, showing how the understanding of basic organic and physical organic chemistry, particularly mechanisms, helps in the discovery and manufacture of industrial processes.

What you will not find in this book is any mention of "chemical development", i.e., how the discovery becomes

*Unsigned book reviews are by the Editor.

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an industrial process. There is no mention of scale-up, batch, or continuous processes. This is not a criticism of the book; it merely serves to emphasise the author's approach to the topic.

The book is full of interesting anecdotes, often related to serendipitous discoveries. But, as Louis Pasteur said, "Chance favours the prepared mind." Some stories relate to patents, and students are reminded of the importance of the accuracy of laboratory notebooks (the subject of an earlier editorial of mine).

One interesting story on the cracking of petroleum and the subsequent build-up of coke deposits relates to a father who was so obsessed with the subject that he called his son Carbon; Carbon then named his own daughters Methyl and Ethyl. In my opinion, any father who saddles his children with such names might be regarded as a well-known arsenic heterocycle!

In conclusion, all organic chemists should read this book for pleasure, not just to learn new knowledge. I hope the authors can be persuaded to write a second volume which covers the fine chemicals industry. If not, maybe that is a project for me for the future.

OP034148P

10.1021/op034148p

Handbook of Metathesis. by R. H. Grubbs. Wiley VCH: Weinheim. 2003. 1156 pp (3 volumes). $260. ISBN 3-527-30616-1.

The literature on olefin metathesis has grown exponentially over the past decade so the appearance of this three-volume handbook is particularly valuable. The individual chapter authors include all of the well-known names in the area, which ensures a uniformly high standard of discussion throughout.

The first volume (204 pages) is devoted to catalysts and catalyst development, the province of the organometallic chemist. Synthetic organic chemists may be tempted to skip this volume and go on to volume 2 which covers organic synthesis applications, but they should not do so. The first volume contains much mechanistic information essential to understanding the various reactions, in particular, side reactions. Only with such a clear mechanistic understanding can efficient processes be developed.

Volume 2 (510 pages) contains everything the industrial organic chemist, whether in discovery or process chemistry, needs to know about olefin metathesis. The chapters cover the key classes of reaction such as ring-opening metathesis, ring closing, ene−yne metathesis, alkyne metathesis, tandem reactions, asymmetric reactions, cross metathesis as well as applications in total synthesis, in combinatorial chemistry and commercial applications. The latter chapter was disappointing from the process chemistry viewpoint, since it was a lost opportunity to explain potential problems of olefin metathesis and how these might be circumvented. In particular, competing oligomerisation can often only be minimised by lowering the concentration, which lowers process efficiency and increases costs, or possibly by dose-control of substrates. In ring-closing metathesis, high temperature favours ring closure over oligomerisation, but this and higher dilution often may encourage catalyst decomposition and require increased amounts of expensive catalyst. According to the index, catalyst loading only gets one mention in the 1156 pages. However, this is a minor criticism which should not detract from the very high quality of the chapters.

The three vignettes provided by the groups of Martin, Danishevsky, and Nicholaou show how the metathesis reaction is particularly suited to the synthesis of extremely complex molecules.

Volume 3 is devoted to polymer synthesis, the area where olefin metathesis was first discovered. This is an extremely important area for industry, and I was surprised that, apart from contributions from the company, Materia, set up to exploit these reactions, there were hardly any chapter authors from industry.

The three volumes contain a wealth of information about every apect of olefin metathesis, and industrial chemists will find inspiration from reading—or even just scanning—the chapters and associated reaction schemes. Chapter 2.2 on ring-closing metathesis, so useful in heterocyclic synthesis, is particularly easy to scan, since each scheme has the literature reference on it. The 23-page index is located at the end of volume 3, meaning you need to have this with you when reading volume 1 or 2. In contrast, the table of contents page for all three volumes and list of contributors (18 pages) is provided in each volume.

In conclusion, this is a major work which should be in every chemistry library as an important reference book. Literature coverage is to mid-2002 in most chapters. The book is well produced and is a good value, even at $260.

OP034149H

10.1021/op034149h

Organic Synthesis Highlights V. Edited by Hans-Günther Schmalz and Thomas Wirth. Wiley VCH: Weinheim. 2003. 440 pp. £55. ISBN 3-527-30611-0.

This is the fifth volume in the series *Organic Synthesis Highlights*, and continues the high standard of the previous volumes. For those readers who have not seen these books, the aim is to summarise in approx 40 chapters, the organic chemistry of the previous 1−5 years, a mammoth task. Each chapter is written by a different author; some of the highlights may have appeared previously in other places, such as *Angewandte Chemie, International Edition*, *Chemistry, A European Journal*, or *Nachrichten aus der Chemie*. If the original article was in German, then the article has been translated into English. I imagine that many of the articles have been updated since they first appeared.

The first part of the book, approximately two-thirds of the work, comprises 26 chapters on such diverse topics as

- Synthesis of Diaryl Ethers
- Palladium-Catalyzed CC-, CO- and CN-Bond Formation on Chloro-Arenes
- Alkyne Metathesis in Natural Product Synthesis
- Transition Metal-Catalyzed Functionalization of Alkanes
- Solvent-Free Organic Synthesis
- Fluorous Technologies
- Recent Developments using Ionic Liquids
- Asymmetric Phase Transfer Catalysis
- IBX - New Reactions
- Asymmetric Baylis−Hillman Reactions
- Catalytic Asymmetric Olefin Metathesis

These are the chapters which should interest organic chemists working in process R&D, but there are others, for example several chapters on solid-phase synthesis that will interest medicinal chemists. Each of the chapters is well-written and just long enough (5−14 pages) to provide in-depth coverage for the nonspecialist in that topic. References are not comprehensive, but the important papers are chosen. Many chapters, however, have references only to 2001 or early 2002.

In the second part of the book, the advances in natural product syntheses are covered in 13 chapters, including Vancomycins, Bryostatins, Eleutherobins, Sangifehrin A, Spirotryprostatins, as well as solid-phase syntheses (Oligosaccharides, Natural Products). A fascinating chapter in this section is entitled "Explosions as a Synthetic Tool" exploring the syntheses of Fullerenes, Buckytubes, and Buckyonions (yes, onions, not anions!). This chapter reminded me of the times I worked on acetylene chemistry and the few occasions when reactions "ran away" to give a black deposit, which of course I never analysed since it was assumed to be charcoal. Maybe it was something more useful, but I discarded it.

This second section made fascinating reading since I do not usually have the time—or always the inclination—to read papers on natural product synthesis. These short summaries were therefore most illuminative. Of course, many of the newer natural products from marine sources are highly active, and when larger amounts are required for testing, they have to be made synthetically. So some of the synthetic routes in these chapters may need to be evaluated by process chemists in the future.

The book is generally well produced, although a minor niggle is that text and associated schemes are separated by as much as three pages. Part of this is due to some chapters having schemes with only four relatively simple structures occupying a whole page (usually the scheme being printed sideways-on) when it could have been reduced to half a page or less. One can understand giving a whole page to schemes involving vancomycin synthesis, but not to much simpler molecules. A reduction in scheme size would have enabled text and scheme to be closer together.

There are a number of typos and incorrect structures which I noted in passing. One chapter is devoid of the required apostrophes to denote possession! Finally, the fact that references are only to late 2001 or early 2002 detracts from the usefulness of the book.

Despite these criticisms, which reflect on the publisher rather than the editors or chapter authors, the volume is an excellent summary of key areas in organic chemistry, and since it is in a paperback as well as hard-back, it is suitable for purchase by individuals as well as libraries. A great book to read on a plane or train!

OP0341566

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Wiley Guide to Chemical Incompatibilities, 2nd Edition. By Richard P. Pohanish and Stanley A. Greene. Wiley Interscience: New York. £85.50. 2003. 1278 pp. ISBN 0-471-23859-7.

This is an updated and enlarged version of the authors' 1997 book entitled *Rapid Guide to Chemical Incompatibilities* and has been renamed. The aim is to help chemists and particularly nonchemists who are involved in health, environment, or safety to judge the chemical incompatibility of reactive substances. For each substance (approximately 3000 in the book) the name, CAS number, information on flash point, instability to heat, and incompatibility with certain chemicals including materials which may be used to package or contain the material are provided.

What is not provided illustrates the major weaknesses of the book for chemists. No synonyms are given, nor are there are cross references. Thus, acetic anhydride is listed, but exactly the same paragraph of 12 lines is repeated under acetic acid anhydride, acetic oxide, acetyl anhydride, anhidrido acetico, (twice) anhydride acetique, anidride acetica. For the same paragraph to be repeated verbatim seven times seems a waste of text when a simple cross reference and/or good index could have provided the same information. As a result, the book is too long for the amount of information contained. I am surprised the publisher did not comment on this waste of paper and the effect on printing costs. This duplication pervades the whole book, not just the isolated example given above.

Second, there are no references to the primary literature, only a two-page bibliography at the end. The key reference in this bibliography should be to *Bretherick's Handbook of Reactive Chemical Hazards*. However, only the 3rd edition, 1985, is referred to, so presumably the authors are unaware of the later three editions!

Third, the physical properties, apart from flash point, are not given. Surely for nonchemists it would be useful to know whether the substance is a solid, liquid, or gas, and its melting and boiling points. Autoignition temperature or decomposition temperature might also be useful in an emergency situation.

Sodium hydride, for example, is described as a flammable solid. The text does not say that it is usually dispersed in mineral oil or that reactivity and handling precautions are affected by whether it is a 40, 60, or 80% dispersion. It is described as reacting, possibly violently, with DMF, but other amides are not listed, whereas it is simply described as incompatible with DMSO.

In conclusion, this work is not recommended for chemists in industry—buy the latest volume of Bretherick's instead.

OP034158Q

10.1021/op034158q

Multiproduct Plants. Edited by Joachim Rauch. Wiley VCH: Weinheim. 2003. 230 pp. $160. ISBN 3-527-29570-4.

This is a translation of a multi-author work, with individual chapters written by BASF engineers, and is therefore very much a BASF view. The small number of references at the end of each chapter are sometimes to internal BASF documents and procedures; other references are predominantly to the German literature.

Multiproduct plants are defined as process plants where a variety of products can be produced, according to market demand, and this definition is further elaborated in early chapters on basic concepts, which are illustrated by an example of dyestuff manufacture by diazotization-coupling. In general the book focuses on batch/semibatch processes (described in the translation as discontinuously operated), although continuous multiproduct plants are mentioned briefly—these could be used for chlorination, hydrogenation, nitration, etc.

In chapter 3, the modular plant is described and includes photographs of various pieces of equipment such as filters and driers and, occasionally, schematic diagrams of their mode of operation. There is an interesting section on pipeless plants such as the Multimix system from Mitsubishi. Finally, this chapter concludes with a couple of pages on cleaning procedures.

The second part of the work is concerned with planning and operating multiproduct plants. It begins with a discussion of basic equipment—agitators, seals, flanges, valves, sensors, pumps, filters, driers, etc., without really discussing the advantages and disadvantages of each type, where a choice is available. It basically describes what is used at BASF. However, cleaning-in-place is given a comprehensive discussion.

Pipelines and connections are given a whole chapter. Materials of construction are discussed in great detail and the reader will learn much from this excellent chapter. Metals and plastics are covered with a short section on corrosion testing.

Process instrumentation, control equipment. and process analysis measurement technology are summarised in chapter 7, which focuses on on-line measurements and automation. Sampling devices is one area that could have been included in this chapter. This is followed by a section on process operation including an example of styrene polymerisation in a multiproduct plant.

Chapter 9 covers material-flow analysis by dynamic simulation, as an aid to more efficient scheduling and equipment usage. It describes the various software programmes available. Chapter 10 is entitled "Process Safety", and although it describes a structured approach to fault analysis, it only briefly mentions HAZOP and its German equivalent PAAG. An appendix of keywords useful in fault analysis is, however, given at the end of this chapter.

The book is clearly aimed at the process engineer, and chemists will find that topics of interest to them (sampling, cross-contamination, etc.) are either only briefly mentioned or not covered. The style of the writing suffers from being a translation, so that phrases such as "not yet reacted" starting material, rather than "unreacted" are used. I felt the book would have benefited from some more examples or case studies. Too often, general statements are made, such as "taking the properties of materials into account" or "once the physical properties of the materials are known, their handling can be discussed", without going on to discuss specific examples which would have helped the reader to understand the issues being discussed.

In summary, the book covers a topic on which the literature is limited and is therefore a useful addition to a library. However, the limitations expressed above should be borne in mind.

OP034170I

10.1021/op034170i

Industrial Dyes; Chemistry, Properties, Applications. Edited by Klaus Hunger. Wiley-VCH: Weinheim. 2003. 660 pp. $255. ISBN 3-527-30426-6.

Wiley-VCH now have a comprehensive set of titles in colour chemistry covering Pigments, Paints and Coatings, and Dyestuffs, and this latest volume is up to the high standard set by previous works. It covers the important chemical chromophores of dye classes, principal applications (reactive, disperse, direct, solvent dyes, etc.), and there are separate chapters on textile and nontextile dying, the latter including leather, fur, paper, hair, food, and photographic dyes. A chapter on functional dyes includes imaging, laser and ink-jet printing, displays and light-emitting diodes, nonlinear optics, etc. A section on Optical Brighteners is followed by the final chapter on Health and Safety Aspects.

The chapter authors are all well-respected, industrial practitioners from the major dye manufacturers or users (Bayer, Dystar, Polaroid, Avecia, Ciba, BASF, Clariant, Wella, and Merck) as well as academic and "retired" industry contributors. The chapters are well written and comprehensive and full of interesting and useful data.

However, two major aspects of industrial production are missing. The manufacturing methodology such as scale-up (e.g. hazards of large-scale diazotisation are not mentioned) and control of crystal form and particle size for ease of filtration are hardly mentioned. Also, analytical specifications, so important for the more recent applications, are not discussed—this area could have warranted a separate chapter. Purification methods could also have been discussed, as well as manufacturing costs.

Despite these criticisms, this is a very useful volume and should be in the library of all dyestuff manufacturers.

OP034175F

10.1021/op034175f

Chemistry in Alternative Reaction Media. By D. J. Adams, P. J. Dyson, and S. J. Tavener. Wiley: Chichester. 2004. 250 pp. £40 (paperback). ISBN 0-471-49849-1.

There is great interest at present in replacing organic solvents, particularly volatile and relatively toxic ones, with alternatives, and this timely volume explores the state-of-the-art. It includes reactions in water, fluorous media, ionic liquids, supercritical fluids, and multiphase solvent systems. Chapters on particular reactions such as the Diels−Alder, hydrogenation/hydroformylation, oxidations, and carbon−carbon bond-forming reactions (Heck, Suzuki, metathesis, polymerisation) are covered in depth. Finally, alternative reaction media in industrial processes are reviewed.

The book is well written and easy to read, very useful for a student audience. Industrial chemists will find the book a pleasant introduction to the subject but may feel that each topic, possibly for space limitations, is not covered in enough depth. They may therefore prefer to go straight to monographs which have recently been published on ionic liquids, supercritical fluids, or even to the older texts on phase-transfer catalysis (PTC) and aqueous-phase homogeneous catalysis.

Important industrial issues such as solvent recovery or reuse are barely touched on, and in multiphase systems, scale-up issues relating to agitation and mass-transfer might have been given more coverage. The chapter which includes PTC fails to mention asymmetric PTC which has been used industrially and in which there has been great progress from the groups of Corey, Lygo, Maruoka, etc. in the past few years. Literature coverage was only to mid-2002.

In the last chapter, great emphasis is placed on the need to move from batch reactors to continuous processes in order to use some alternative solvents. Whilst the needs of process intensification are valid, it is unlikely that industry will use alternative solvents if they also have the expense of new equipment, and alternative solvents need to be designed for use in batch (I prefer to use semi-batch) processes, at least initially. What proponents of continuous processes forget is that a batch reactor is not only a reactor but a work-up vessel, a crystalliser, and sometimes a distillation pot, i.e., it is versatile. A continuous reactor is only a reactor, and work-up and product isolation needs other equipment. Continuous work-up and other unit operations (particularly crystallisation) need to be developed in addition to focussing on the reaction, and the development time will inevitably be longer.

For alternative reaction media to have any impact on the environment, it is important that industrial chemists are educated in green principles. This book will introduce the subject to a wider audience and should be the first step to producing more environmentally friendly process chemists.

OP034185G

10.1021/op034185g

Marketing and Sales in the Chemical Industry, 2nd Edition. By R. Jakobi. Wiley−VCH: Weinheim. 2002. 177 pp. £60/85 Euro/$105. ISBN 3-527-30625-0.

What an enjoyable read! The preface indicates that the target audience is the scientific and engineering community and not the marketers, and this slim volume is highly recommended, particularly the early chapters. The style is focussed towards scientists, with chapter titles such as the "main group elements" of marketing.

The author focusses on the relationship between customers and products and particularly on behavioural aspects which influence buying decisions. Later chapters discuss the different market sectors such as commodities, plastics and rubbers, speciality chemicals, agrochemicals, and pharmaceuticals. If there is a weakness, it is that there is not a chapter on fine chemicals and intermediates. The last three very short chapters are on electronic commerce, emerging markets, and outlook for the future. An extensive reading list, mostly to the German literature, is provided along with a comprehensive index.

Highly recommended!

OP034190K

10.1021/op034190k

Catalysis in Action. By S. D. Jackson, J. S. J. Hargreaves, and D. Lennon. Royal Society of Chemistry: Cambridge, UK. 2003. £99.95. 318 pp. ISBN 0-85404-608-9.

The RSC are to be congratulated on publishing these proceedings of an International Symposium on Applied Catalysis (University of Glasgow, July 16−18, 2003) a month before the conference took place! The meeting marked the retirement of Professor Webb of Glasgow and focused on hydrogenation, deactivation, chiral catalysts and environmental catalysis, on which he made significant contributions during his academic career.

Of course, in this context catalysis means heterogeneous catalysis, and the book is therefore of most interest to industrial chemists and engineers working on continuous processes in the bulk chemical industry. Of the 43 papers, only a few will be of interest to process chemists working on batch/semibatch processes. Examples include hydrogenation of cinnamaldehyde to cinnamyl alcohol, aldol condensa-

tions, hydrogenations in ionic liquids, and enantioselective hydrogenation of amino acid derivatives.

OP034194P

10.1021/op034194p

Microwaves in Organic Synthesis. Edited by Andre Loupy. Wiley-VCH: Weinheim. 2002. 159 euro. 499 pp. ISBN 3-527-30514-9.

Microwave-assisted organic chemistry was first reported in 1986, with the appearance of two papers in peer-reviewed chemistry journals. By the mid-1990s there were more than 200 publications, and by 2002 there were over 1000, indicating the continually growing interest in this area.

This book provides a comprehensive overview of the state of play in the application of microwaves in organic synthesis. It consists of 14 chapters by 28 different researchers, essentially all of whom are recognised experts and contributors in the field.

The opening chapter provides a helpful introduction to the fundamentals of microwave−matter interactions, microwave reactor design, and laboratory and industrial equipment, the latter usefully reviewing all of the commercially available microwave equipment for organic chemistry. The application of microwaves to "commercial scale" organic synthesis (in a flow-through sense) is hinted at, but no concrete example is given. The reader therefore concludes that scale-up is currently still a potential limitation.

After an intervening chapter reviewing organic chemistry performed in pressurised reactors, there follows a chapter entitled "Nonthermal Effects of Microwaves in Organic Synthesis". This is clearly still a controversial area, and this particular reviewer was left none the wiser as to whether "nonthermal microwave effects" in organic synthesis actually exist. (Indeed, the authors of Chapter One had concluded they did not!) Nevertheless, it made for interesting reading!

The remainder of the book is essentially a review of the literature of microwave-assisted organic synthesis divided into individual chapters covering homogeneous media, phase-transfer catalysis, supported reagents, reactions on graphite, heterocyclic chemistry, cycloadditions, catalytic reactions, transition metal catalysis, combinatorial chemistry, radiochemistry, and photochemistry. Almost every conceivable organic reaction has been performed with microwave assistance somewhere, and this book serves as a useful entry point to the appropriate literature. Chemists with ready access to a laboratory microwave reactor will be well served by this volume.

As is likely in a work of this nature, there is often overlap in coverage across some of the chapters. In addition, the grammar leaves a bit to be desired in a number of places (most obviously on the back outer cover—bringing into question the quality of the proofreading!), but overall these observations do not detract significantly from the overall impact and utility of the book.

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OP034195H

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Asymmetric Catalysis on Industrial Scale: Challenges, Approaches and Solutions. Edited by H. U. Blaser and E. Schmidt. Wiley-VCH: Weinheim. 2004. £115. 454 pp. ISBN 3-527-30631-5.

The award of a 2001 Nobel Prize to Knowles, Noyori, and Sharpless for their work on enantioselective catalysis provided high-profile public recognition of outstanding progress in this vibrant area of organic synthesis. Most importantly, it highlighted the fact that asymmetric catalysis is not solely the preserve of the academic researcher but is also strongly driven by, and benefits from, industrial developments and needs, the basis of the award to W. S. Knowles being the ground-breaking L-DOPA process for Monsanto.

Numerous books, reviews, and monographs on the science of enantioselective catalysis have been published in recent years, including a number which focus on industrial aspects. Indeed the *Organic Process Research & Development* journal is an important vehicle for the latter. It is therefore very pleasing to report that this latest volume is *not* an "also-ran" but is, in fact, an outstanding addition to our knowledge base.

The L-DOPA story, as told by W. S. Knowles himself, is one of 25 case studies collected together in this book, written by leading industrial researchers in the fine chemicals, agrochemicals, and pharmaceuticals industries, and encompasses homogeneous catalysis, heterogeneous catalysis, and biocatalysis. Each case study describes not only the research (or screening) phase of the programme, but also the development and scale-up, including the "fit" of the catalytic step in the overall process, typical problems encountered, and also unsuccessful approaches. While in most cases the chemistry (i.e., bond-forming sequence) has been previously disclosed (often only in patents, sometimes in congress proceedings, and sometimes in the primary chemistry literature), the process development and large-scale focus provided here provides the reader with fresh insights in a very readable format. All chapters have been written to a uniformly high standard.

The case studies are prefaced by an introductory chapter which provides a helpful overview of the book's contents, together with an important section entitled "Missing Processes", which lists relevant industrial processes which have been described in reasonable detail elsewhere. The editors have clearly taken a comprehensive view of the status of asymmetric catalysis on industrial scale, and this is therefore

a reference book which should be on the shelves of all scientific libraries.

In their introductory chapter, the editors defined their central goal for the book: "To show the organic chemist working in process development that enantioselective catalysis is not just an academic toy but is really a suitable tool for large scale production of enantioenriched intermediates. To serve as a source of information and maybe also inspiration for academic research and last but not least strengthen the position of the industrial catalyst specialists working in the exciting but sometimes frustrating field of enantioselective catalysis." This goal has been amply fulfilled.

I highly recommend this book to all organic chemists in industry and academia, but particularly those in development and production. Not only is it an excellent reference work, it is also a thumping good read!

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OP034196+

10.1021/op034196+

Re-engineering the Chemical Processing Plant: Process Intensification. Edited by Andrzej Stankiewicz and Jacob A. Moulijn. Marcel Dekker: New York. 2004. $165. 529 pp. ISBN 0-8247-4302-4.

The book began life after a paper on Process Intensification: Transforming Chemical Engineering, published in *Chemical Engineering Progress* in January 2000, received an enthusiastic response. It is very much a chemical engineer's view of process intensification and covers topics such as chemical processing in high-gravity fields, the spinning disc reactor, compact multifunctional heat exchangers, microreactors, structured catalysts and reactors, inline and high-intensity mixers and multifunctional reactors, as well as chapters on industrial practice (very much a DSM view), and process intensification in safety and sustainable development. All the major players in this field have provided chapters which are well written, detailed, and well referenced. For the process chemist, the view of the book will seem focussed towards the bulk chemical rather than the fine chemical industry. At a recent UK meeting on Process Intensification (PI), it was clear that for PI to progress, the engineering community will need to engage the process chemist and convince him or her to move away from batch/semibatch chemistry towards continuous processes. Many factors mitigate against this—the ease of running batch processes on very small scale when raw materials are scarce, the small amount of development time allowed before scaleup to make product that is required, and the aggressive time scale for development. Engineers may be better at addressing second-generation process development (i.e. after a product is launched) than in trying to introduce PI to the fine chemical and pharmaceutical industries.

The PI community do not help themselves by their lack of understanding of the way chemists work and of the pharma industry. Thus, there appear statements such as, "The popularity of the stirred vessel is due to its perceived simplicity and adaptability, coupled with the fact that it is superficially straightforward to the scale up from the laboratory beaker (my emphasis!) that was used when the process was being developed." It is clear that many engineers have never been in a modern process chemistry lab!

On page 70 it is stated, "This has led the relevant regulating authorities (e.g. U.S. FDA) to insist on a process validation at lab, pilot and full scale. Since each validation entails significant administration and delay, the procedure can hold up the implementation of commercial production by several years." This is just not true!

A related misstatement refers to the pharma industry and is the implication that the long lead times for pharmaceuticals to reach the market is mostly caused by the difficulties of scaleup to batch reactors. In my experience the bulk production of drug is rarely on the critical path for launch of product! The statement is made that "the start of commercial production can be greatly speeded up, in some cases by several years by the use of PI". "Time to market will be shortened and the patent lifetime of the drug will be much more effectively utilised." Whilst this may be true for a fine chemical product or even a key drug intermediate which is outsourced, it is clearly overselling PI to imply that it has an effect on the launch dates of a new drug and hence its patent lifetime.

These statements show process chemists that some members of the chemical engineering community may be out of touch with the harsh realities of process development in the modern pharmaceutical industry, where the chemical complexity of the new pharmaceuticals and the need to "fix" the drug synthesis route at an early stage leave little time to explore the possibilities offered by PI, however attractive they may be.

Despite these criticisms, the book offers a detailed and up-to-date account of some—but not all—technologies related to PI and gives industrial examples—many from the Dutch company DSM, where one of the authors works—where these have been introduced into manufacture.

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Green Chemistry: An Introductory Text. By Mike Lancaster. Royal Society of Chemistry: Cambridge, UK. 2002. 310 pp. £25. ISBN 0-85404-620-8.

The Royal Society of Chemistry's Green Chemistry Network, initiated and developed by James Clark and colleagues at the University of York, has played a very important role in championing this field, not least through the RSC journal *Green Chemistry*. Mike Lancaster, the author of this book, was the manager of the Green Chemistry Network from 1998 to 2002 and is therefore well placed to write such a volume, which is one of the "RSC Paperbacks" series.

Green Chemistry: An Introductory Text is based upon undergraduate and Masters courses in Clean Chemical Technology at the University of York. It is therefore aimed primarily at students and lecturers, although it may also serve as a useful entry point for industrial chemists, engineers, and managers wishing to gain a broad appreciation of green chemistry.

The first chapter surveys the principles and concepts of green chemistry (focusing primarily on atom economy, but with sections on sustainable development and toxicity). The ensuing chapters cover waste minimisation, green metrics, catalysis, environmentally benign solvents, renewable feedstocks, emerging greener technologies and energy sources, and the design of greener chemical processes. The penultimate chapter is devoted to industrial case studies (taken from a variety of industrial settings), and the book concludes with a forward-looking section considering the various barriers and drivers to a greener chemical industry.

The author presents a balanced perspective, which succeeds in promoting green concepts, without "overselling" them (a criticism often levelled at some practitioners of some of the newer green technologies). There are parts of the book which the majority of process chemists will find less valuable (e.g., fuel cells), but their presence is important, since it completes the overall green chemistry context within which the process chemistry aspects lie.

The concepts are described in simple language and illustrated with numerous real examples, but references to the primary literature are (deliberately) minimal, which more advanced readers may find a little frustrating. There are suggestions for further reading at the end of each chapter, together with a set of "review questions" which encourage the reader to apply the concepts to new situations.

Unfortunately, there are a number of graphical errors and some untidiness in the structural diagrams throughout the book (e.g. furan rings where the oxygen label has been omitted, starting materials with incorrect numbers of carbon atoms). These do detract slightly from the book's impact, but overall this is a very readable work. While a number of green chemistry books have been published over recent years, this book has a unique style which complements the existing publications, and at £25 it is accessible to many.

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