

emphasis lies. That approach has resulted in a relatively bulky textbook of over 900 pages.

The contents are arranged in five sections, process engineering being treated in the usual way in Sections 1, 3, and 4. The only aspect not covered as thoroughly as one might wish is that of residence times in reactors. The thermodynamically nonideal behavior of reaction mixtures (which unfortunately many authors fail to cover adequately) is treated in detail here. It is also pleasing to find that special aspects of reaction technology such as semibatch operation and nonstationary states are covered. Section 2 provides an excellent description of the principles of heterogeneous and homogeneous catalysis, including many practical examples which add to the reader's interest in the subject. Section 5 is the part that especially marks this out as a modern book. Here, in a way that one does not find in conventional textbooks, the author describes and discusses in detail some new concepts in process engineering that lead to improvements in selectivity and reaction rates. Examples of the topics discussed include multiphase liquid reactors, biochemical and electrochemical syntheses, reactors using ultrasonic or microwave energy, membrane reactors, and multifunctional reactors, as well as syntheses under supercritical conditions.

Doraiswamy intends the book to be used by both chemists and process engineers, as is emphasized by the fact that he often addresses comments directly to each of these groups. He succeeds in this dual aim largely by keeping the chemical reaction, which is at the heart of reactor design, in the foreground as the starting point of the concept of the reactor, rather than treating it in general terms or giving only a few examples. Thus, the proportion of material of a purely chemical nature is unusually large for a book on process technology. However, in our view the treatment of process engineering aspects is too detailed for chemists, going far beyond the basic knowledge that is sufficient for those readers. On the other hand, the process engineer will benefit from an interesting survey of the main chemical aspects, and will also find answers to detailed questions on reaction technology.

The contents are too detailed and extensive for a student textbook, unless the student is prepared to accept that some of the material is too advanced to assimilate. Moreover, our first impression was of a manuscript bound in a hard cover rather than of a modern textbook. In particular the diagrams and figures are not up to modern standards. Because the visual impression affects one's reading and learning, and may also influence the decision whether or not to buy the book, both the internal and external appearance need to be modernized; otherwise they spoil the impression made by the book, despite the excellent quality of its contents.

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Handbook of Vibrational Spectroscopy. Vols. 1–5. Edited by *John M. Chalmers* and *Peter R. Griffiths*. John Wiley & Sons, New York 2002. 3862 pp., hardcover £ 1345.00.—ISBN 0-471-98847-2

Scientific progress is generally reported in original papers, reviews, and monographs. Their role is to present the latest facts and research results, and these are then evaluated within the narrow scientific circle to which the work belongs. This process seldom includes connections with other areas of work and related disciplines, and indeed, because of the constant flood of new scientific publications, those interdisciplinary aspects do not receive the amount of attention that would often be desirable. Thus, for areas of research that have undergone rapid development, or have such a wide-ranging potential that their applications have expanded into new fields not originally envisaged, it is all the more important that from time to time there should be an overall review of the state of progress, in which experimental results and theoretical models are evaluated and put into some order. At a more mundane level,

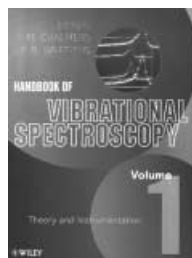
such a review can also look for new technological applications. This need is especially great for such a fundamentally important method as vibrational spectroscopy, which can look back on many years of technical development, and has also given rise to a wide variety of modern applications. The editors of this *Handbook of Vibrational Spectroscopy* have aimed to provide a comprehensive overview of the kind described above, covering methods, instruments, technical developments, and applications. They have achieved that in a 5-volume work of some 4000 pages containing 239 individual articles.

The contents are arranged clearly and systematically. Volume 1, with nearly 900 pages, contains detailed descriptions of the theory of light absorption, of infrared spectroscopy, and of the Raman effect, followed by articles describing a wide variety of instrumental methods and techniques. The aspects covered include the different types of detectors, monochromators, and interferometers, the many variants of the principle of nonlinear Raman spectroscopy, the various SERS (stimulated emission Raman spectroscopy) techniques, methods based on circular dichroism, and the latest laser spectroscopy instruments using frequency mixing. Volume 1 ends with an important chapter on wavelength calibration and photometric quantities.

Volume 2 begins with discussions of a conventional sample preparation, but soon moves on to thin film techniques, techniques of infrared and Raman spectroscopy, and microspectroscopic methods, to name only a few of the topics. This volume too ends with an important chapter, describing anomalies, artefacts, and errors which can arise, both of a general kind and those relating to special techniques.

Volume 3 begins with chapters containing detailed descriptions of the group frequencies of organic, inorganic, and polymeric compounds, with many tables of data. These are followed by chapters on normal coordinates analysis and the calculation of predicted vibrational frequencies. The second part of this volume contains articles on signal processing and spectrum analysis.

The last two volumes are devoted to applications. Articles in Volume 4 de-



scribe the use of vibrational spectroscopy for the characterization of polymers, silicones, thin organic films, semiconductors, and superconductors. These are followed by examples of applications in atmospheric diagnostics, catalysis, and industrial processes. Lastly, the articles in Volume 5 cover medical applications such as diagnostic examination of the epidermis and tumor recognition, the spectroscopy of biologically important molecules such as proteins and lipids, and Raman spectroscopy of viruses, to name only a few of the topics. The volume is completed by examples of applications in the areas of pharmacy, agriculture, and food science.

This quick gallop through the contents of the work can only give a very incomplete impression of it. The list of topics and areas could be considerably extended, and even then would still only give an incomplete picture of what this handbook offers to the reader. In the space of this review it would not be remotely possible to discuss any individual articles in the detail that they deserve, as that would be unfair to the many others that were not mentioned.

Nearly all the articles show a high degree of meticulous care by the authors. I did not find examples of slipshod explanations or derivations anywhere in the work. While it is true that not all the articles are of the same high quality, none give cause for criticism. In general one is much impressed by the thoroughness of the discussions and the amount of detail, and the authors have avoided compromises that might convey a quick but only superficial understanding.

Thus, this is not simply a work in which one looks up facts—instead it aims to convey both knowledge and understanding. To make proper use of

it, the reader needs to learn a lot of details and work through the articles thoroughly. Thus it is a remarkable handbook which revives the tradition of good scientific education. That is in marked contrast to an age characterized by hurriedly absorbing bits of information through the almost unlimited access offered by the Internet and “streamlined” courses of study.

Although the individual articles vary to some extent in style and structure, the differences are small and do not detract from the work. Each chapter treats its subject in a way that can stand alone and be read independently. There are cross-references between chapters and volumes, especially in Volumes 4 and 5 to the earlier chapters dealing with methods and theory, thus emphasizing the interrelation between the chapters in the work as a whole. In any case, the reader will soon become confident that anything concerned with vibrational spectroscopy can be found within the handbook. Moreover, the handbook is not simply a collection of independent articles. The tight organization and structure of the volumes ensures that it is more than that. The introductions to each of the volumes also help to show the connections between the parts.

In keeping with the comprehensiveness and amount of detail in the handbook, there is a very extensive subject index. Here too the editors have set a new high standard. Approximately 6900 keywords cover the contents of the five volumes. Even though this handbook is not just a reference source for quickly looking up individual terms, the remarkably large subject index is a reliable resource to help one find information on specific topics. The carefully prepared glossaries are an additional useful aid.

The only small complaint is that the individual volumes do not have separate subject indexes. However, that is in accordance with the editors' approach of consistently viewing the work as a whole.

The work is well provided with illustrations, and the figures are of a uniform style, including good quality color figures where they are needed for greater clarity. The many photographs are informative and well integrated into the text, although some would have been better if reproduced in a larger format.

The logistic work, which enabled the organization of the handbook, is applaudable. To have successfully coordinated and assembled the contributions of so many authors on such a wide range of topics is a remarkable achievement, even in this age of electronic networking. Also, despite the considerable time that has been needed to prepare the handbook, the literature coverage in articles on areas undergoing rapid development extends to very recent publications.

What is my personal verdict about this handbook? It is a remarkably successful achievement by the editors and the authors. In short, I am wildly enthusiastic about it. However, to call it a handbook greatly understates its merits. It is an encyclopedia of vibrational spectroscopy, and recalls the long tradition of great encyclopedic works that have been generated by the desire to present clear and comprehensive information. I believe that the *Handbook of Vibrational Spectroscopy* will become the standard work on the subject and will remain so for a long time.

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