

BOOK REVIEWS

Techniques for Characterization of Electrodes and Electrochemical Processes

Edited by Ravi Varma and J. R. Selman. *The Electrochemical Society Series*. Price £89.70. ISBN 0-471-82499-2.

This book is concerned with descriptions of *in situ* or quasi *in situ* techniques for the characterization of electrode surfaces and processes used in application areas such as electrocatalysis, electrodeposition, batteries and fuel cells. The book consists of 15 chapters, the majority of which deal with spectroscopic techniques that can probe the structure and composition of electrodes, electrolytes and products formed during electrolysis. The remaining chapters deal either with electrochemical measurement techniques or mathematical modelling approaches. The individual chapters have been written by acknowledged experts in their own fields, and provide a good theoretical background on the various techniques described. Each chapter also gives a good description of the instrumentation involved before going on to discuss selected applications. Although the individual chapters are not exhaustive in their coverage, and in many cases highlight the individual author's own work, the book will provide a good basis for all those interested in becoming involved in this area of research. While the coverage of the book concentrates on *in situ* or quasi *in situ* techniques, I felt the book would have benefited from some treatment of other spectroscopic and microscopic methods that are commonly used to look at electrode surfaces out of solution. In particular I would have liked to have seen a chapter on the emerging technique of scanning tunnelling microscopy (STM). I can, however, recommend the book as a good guide to methodology used to probe electrode surfaces and reactions *in situ*, and should be on the shelf of any library serving chemical, electrochemical or industrial needs. The cost may be prohibitive for private purchasers.

Malcolm R. Smyth

Chemical Aspects of Enzyme Biotechnology. Fundamentals

Edited by Thomas O. Baldwin, Frank M. Raushel and A. Ian Scott. Pp. ix + 359. Plenum. 1991. Price US \$85.00. ISBN 0-306-43815-1.

This book is composed of the papers given at an international symposium (the first of two) devoted to enzyme biotechnology, the eighth in a series sponsored by the Industry-University Cooperative Chemistry Program. The papers represent a mixture of research and semi-review presentations covering enzyme mechanisms, protein structure and protein engineering and the industrial use of enzymes. This produces a text that addresses current developments in enzyme biotechnology through the vehicle of individual examples; indeed almost one third of the book is devoted to vitamin B₁₂.

There are four papers on the subject of enzyme mechanisms describing the effects of metal ions on the activity of glutamine synthase, structure-function relationships of mandelate racemase, knowledge of enzyme mechanisms for the design of herbicides and hydrolysis of phosphotriesters. Each of these papers illustrates the intricate nature of the active site albeit with the limited perspective of the specific examples used.

The four papers on protein folding illustrate a range of chemical processes that contribute to the complex structure of proteins and the influences on enzyme kinetics and stability. The paper on ways of increasing enzyme stability illustrates a

problem I had when reading the book overall; it only provides a cursory review of the subject, together with a limited amount of data. My preference for a text purporting to present fundamentals is a more detailed review and treatment of data available in the literature. The papers in this section do, however, provide an interesting insight into the techniques used in the study of protein folding.

The two papers on protein engineering, one dealing with aspartate transcarbamoylase and the other on the subject of catalytic antibodies do provide a glimpse of the 'dream of designer enzymes' (to quote the editors). My preference for a text would have been to give more emphasis to this section of the book. Indeed, on reflection, I would have preferred to see the bulk of the book devoted to the topics featured up to this point.

The section on 'applications' begins with the development of oxytocin antagonists and the design of peptide ligands that interact with specific membrane receptors. This is followed by four papers describing the use of enzymes in organic syntheses. All of these papers illustrate the molecular complexity of catalytic activity and the rewards of harnessing its power.

Books based on symposia will always appeal to those who would have enjoyed the spoken presentations—but not necessarily a wider audience; this text is an example of this phenomenon. This book will appeal to specialists in the field, although most of the material is available in the journal literature. If the potential reader is looking for a text to explore the fundamentals of enzyme biotechnology, then there are probably more comprehensive texts available.

C. P. Price

Surface Phenomena and Fine Particles in Water-Based Coatings and Printing Technology

Edited by Mahendra K. Sharma and F. J. Micalé. Pp. viii + 333. Plenum Press. 1991. Price \$79.50. ISBN 0-306-43724-4.

This book is composed of 24 papers selected from those presented at the International Symposium on Surface Phenomena and Fine Particles in Water-Based Coatings and Printing Technology held in Boston in August, 1989. Recent environmental legislation regarding the emission of and exposure to organic solvents has stimulated interest in water-based coating and printing systems. Attention has focused on problems such as slow drying and the need for stable dispersions that have low foaming but good wetting and adhesion properties whilst maintaining good cohesion and barrier properties. The purpose of the conference was to examine the interrelation between processes and properties and surface chemistry in all its aspects. As is usual in compilations of this kind, the papers are diverse in content. The editor has divided them into three categories: (i) water-based inks and coatings, (ii) emulsions and adhesion in coatings, and (iii) characterization of coating and printing materials.

An introductory paper (Sharma) and a review paper on the design of water-based inks and coatings (Podhajny) help set the scene. Similarly broad papers on the film coating of pharmaceutical tablets (Porter; Masih, McHan and Masih) provide a useful introduction to this important topic.

As might be expected, few novel systems are discussed. A paper on the use of a hydrophilic and/or hydrophobic block microgel in coatings (Yagi) is an exception, and the use of block copolymers of styrene and ethylene oxide as steric stabilizers (Bahadur) has novelty of application. A discussion of the Eastman polyesters (Raynolds) suggests some interesting particle structures. A concise account of the surface

chemistry of alkyd resins (Hofland, Schaap) is very much in the spirit of the conference. The need for extensive characterization of latex systems is well illustrated in a study of adhesive failure in acrylic films (Palackdharry).

The characterization of particle size and particle size distribution is addressed in papers on disc centrifugation (Thomas, Fairhurst) and low-angle light scattering (Plantz), although microscopy, in its various forms, appears to be the most widely applied technique. A study of factors affecting surfactant migration in films by FTIR techniques (transmission, attenuated total reflection and photoacoustic) provides interesting evidence of the effects of water-flux and mechanical stress (Evanson, Urban). The advantages of dynamic surface properties over equilibrium properties for characterization of dispersions is noted (Berger, Berger).

Monodisperse latices are ideal systems for the study of interparticle interactions and dispersion structure and viscoelasticity. A comprehensive study (Lee, Micale) of polystyrene particles includes the interesting b.c.c. and f.c.c. 'crystal' structures formed at high particle concentrations. Similar latex dispersions were used (Tadros, Warzynski, Zembala) to test the theory of deposition of particles in the presence of polymer and so to explain the different effects of adsorbed layers of poly(ethylene oxide) or poly(vinyl alcohol) on the rate of deposition of negative polystyrene latex particles onto positive mica sheets. The use of model systems seems an obvious route towards understanding the complexities of commercial formulations.

The book is produced from camera-ready copy and the quality of presentation is variable. The index is rudimentary. The book will provide a useful reference for those with a working interest in the field and will be needed by specialist libraries. It cannot be recommended for general reading.

Alison Bedells

Pearson's Composition and Analysis of Foods. 9th Edition

By Ronald S. Kirk and Ronald Sawyer. Pp. x + 708. Longman. 1991. Price £49.00. ISBN 0-582-40910-1.

This is the ninth edition of what is regarded by many as the food analysts bible. The change in title from 'Chemical Analysis of Foods' to 'Composition and Analysis of Foods' emphasizes the increasing importance of EC Directives and the international requirements of organizations such as the Codex Alimentarius Commission, in food analysis.

As in previous editions the book is split into sections dealing with general chemical and then instrumental methods of analysis followed by consideration of specific areas (*i.e.*, additives, contaminants, sugars and preserves, fruit and vegetable products, cereals and flour, starch products, baking powders, eggs and salad cream, beverages and chocolate, herbs and spices, salt, fermentation products, flesh foods, dairy products and oils and fats).

In addition, the book contains a number of Appendices giving detailed information on both national and international standards ranging from international organizations that issue analytical methods for food commodities, Codex Standards, EC Directives and Regulations, food composition and labelling, UK codes of practice, food surveillance papers, through to serial numbers of permitted food additives, titrimetric analysis data, SI conversion factors (even if SI units are not used religiously in the book) and even selected atomic weights!

Each chapter contains information not only on the methods of analysis appropriate to the subject area of that chapter but also information on the composition, properties and legislation appropriate to the subject of each chapter. Thus a

complete picture for each subject area is presented, and not only the analytical aspects. The book is, therefore, a valuable source of reference to the food analyst.

The book does have three major drawbacks, however, which should be addressed in future editions. It is unfortunate that as this edition was finalized in 1989/90 it precedes the 1990 Food Safety Act, and thus that Act is scarcely mentioned. The changes introduced by the Act are significant and some description of them should be given in future. Many of the methods given do not include analytical performance parameters. As these are going to be of increasing importance, *e.g.*, it is likely that as a result of EC legislation all methods used in cases of dispute will have to be fully validated, then some consideration should have been given to including such parameters. There are a number of 'newer' techniques that have been omitted, *e.g.*, immunoassay methods have come to the fore in the analysis of aflatoxins in peanut butter in recent years although it is scarcely mentioned as an alternative technique and quotes the most recent reference as 1986. The section on post-harvest fungicides quotes references ranging from 1974 to 1984.

In conclusion, a valuable reference book for all food analysts, but one in which the authors will have to give careful consideration as to its content in future editions.

R. Wood

IARC Monographs on the Evaluation of Carcinogenic Risks to Humans. Volume 52. Chlorinated Drinking-water; Chlorination By-products; Some Other Halogenated Compounds; Cobalt and Cobalt Compounds

International Agency for Research on Cancer, World Health Organization. Pp. 544. IARC. 1992. Price Sw Fr 80.00. ISBN 92-832-1252-5.

The main bulk of this book concerns the implications in terms of the risk of cancer for man in the chlorination of drinking water and the possible carcinogenic activity of chlorination by-products. In addition, monographs are presented for bromoethane, chloroethane and 1,1,2-trichloroethane and for cobalt and cobalt-containing compounds.

Several years ago, considerable attention was paid in the media to the fact that chloroform, classified by the IARC¹ as an animal carcinogen, is formed, along with other chlorinated by-products and acetaldehyde and formaldehyde, as a consequence of the chlorination of drinking water. The present monograph on this topic considers the results of numerous, mainly *in vitro*, tests for genotoxicity, a limited number of rather trivial animal experiments and a number of rather uncritical epidemiological studies only to conclude, as might have been expected, that 'chlorinated drinking water is not classifiable as to its carcinogenicity to humans'. The most sensible comment on the subject, however, appears not in the monograph itself but under the heading General Remarks in the preliminary pages of the volume. Here it is stated, as most of us knew already, 'There are substantial and irrefutable benefits of disinfection of water supplies by chlorination. Any major change to these programmes would need to be evaluated as to its costs and benefit with regard not only to the need to maintain microbiological safety but also to the long-term adverse effects of alternatives to chlorination'.

The animal carcinogenicity test data for sodium chlorite and hypochlorite salts are considered inadequate and in neither case are the data directly relevant to the evaluation of cancer risk for man. For several of the individual halogenated chemicals looked at, there was limited or insufficient evidence for them to be classified as animal carcinogens, but in no case was there direct evidence of carcinogenicity for man. The reviews of the data for cobalt and various cobalt compounds

led to the similarly unhelpful conclusion that 'Cobalt and cobalt compounds are possibly carcinogenic to humans'.

Much of the value of the books in the IARC series is the thoroughness with which the available literature is assembled and with the care with which the data are considered. The facts that most detract from their value are, first, the limited nature of the list of alternative conclusions that can be reached (*i.e.*, Group 1, carcinogenic to humans; Group 2A, probably carcinogenic to humans; Group 2B, possibly carcinogenic to humans; Group 3, not classifiable; Group 4, probably not carcinogenic to humans). It is not possible on the basis of this simple categorization to distinguish highly dangerous chemicals, or situations, from ones of no more than possible limited concern. Secondly, the continued refusal of the IARC to make any attempt to distinguish between genotoxic and non-genotoxic mechanisms in carcinogenesis is serving to render their stereotyped conclusions out of tune with the times and far less useful than they could otherwise be.

F. J. C. Roe

Reference

- 1 IARC, *Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans: Some Halogenated Hydrocarbons*, 1979, vol. 20, p. 401.

Essential Oils and Waxes

Edited by H. F. Linskens and J. F. Jackson. *Modern Methods of Plant Analysis. New Series Volume 12*. Pp. xviii + 338. Springer-Verlag. 1991. Price DM285.00. ISBN 3-540-51915-7; 0-387-519.

As indicated by the title, this is the 12th volume in a series devoted to the analysis of plants and plant products. The aim of the series is to cover as many aspects as possible with each volume devoted to specific classes of substances rather than to particular techniques. Inevitably this leads to some measure of repetitiveness, particularly among the more popular forms of chromatography, although this has been kept to a minimum.

The book itself contains 18 chapters from 27 contributors and covers a very wide diversity of subjects, many of them being highly specialized. It is disconcerting to find that the first and last chapters, which are devoted to lipids, are outside the scope of the title of the book, and as the first chapter, which is on olive oil, deals mainly with its quality control, the initial impression is disappointing. However, the following nine chapters are devoted either to specific essential oils or to a group of essential oils derived from specific species of plants. Essential oils covered are those of tea, thymus, mentha, ginger, garlic, juniperus, cedarwood, croton and eucalyptus.

The chapters on thymus and mentha give details of the chemical composition of the essential oils from various species and outline the analytical methods which can be used. In the case of the chapter on ginger, emphasis is placed on the separation and identification of its complex mixture of sesquiterpene hydrocarbons. A discussion of ^{13}C NMR is included. The following chapter gives a very detailed description of the analysis of sulfur compounds in garlic using computer-aided mass spectrometry in conjunction with relative retention indices.

Juniperus and cedarwood oils are the subjects for the next two chapters and are discussed in relation to species and their agronomy. There then follow two chapters on the application of two lesser known forms of chromatography to the analysis of croton oil. These are reversed-phase overpressure layer, and rotation locular countercurrent chromatography. The section devoted to essential oils is then concluded by a chapter on the vacuum distillation of eucalyptus, which provides both

essential oil and waxes, and leads into the final section that contains, among others, chapters on epicuticular waxes and waxes accumulated in soils. The remaining chapters cover a general view of flower and pollen volatiles, monoterpene hydrocarbons in the atmosphere, bioactivities of diterpenoids from marine algae and the antimicrobial activities of essential oils.

Overall, the book lacks coherence and whilst it covers some very specialized topics the analytical techniques that are applied are mostly of a routine nature.

A. M. Humphrey

Trace Metal Analysis and Speciation

Edited by I. S. Krull. *Journal of Chromatography Library. Volume 47*. Pp. xvi + 302. Elsevier. 1991. Price US\$123.00; Dfl240.00. ISBN 0-444-88209-X.

We live in a reductionist age, sadly exemplified by the near-ritualistic division of chemistry departments, at least in many British higher education institutions, into sections of physical, inorganic and organic chemistry and then into semi-isolated sub-sections of ever increasing specialization. This has resulted in the well-known squeeze on analytical chemistry, save for those areas perceived as strongly supportive of synthesis. Even within analytical chemistry, however, there has been an obvious, perhaps inevitable, tendency to specialize, with practitioners looking upon themselves as spectroscopists, chromatographers, electroanalytical chemists, radioanalytical chemists *etc.* 'Oh, east is east, and west is west, and never the twain shall meet . . .'

But there is hope, as shown by this refreshing book on hybrid analytical techniques that arose out of a mini-symposium held at the Eastern Analytical Symposium in New York in 1987. The nine chapters of this multi-authored book review the development and application of hybrid techniques involving chromatography to the quantitative determination of specific forms of trace metals and other elements in a range of sample materials. In this respect, it honestly addresses challenges in elucidating the behaviour of chemical species in the real world, both natural and anthropogenically influenced, which confront those such as environmental chemists, biochemists and toxicologists.

Although the book was not published until 1991, four years after the symposium, the authors (13 USA, 1 Australian, 1 Chinese) have reviewed the literature to 1989 and, in a few cases, to 1990 or 1991. The chapter titles reflect the flavour of the book. Chromatography-element-selective detection: interfacing of gas chromatography with microwave-induced plasma emission detection (GC-MIP) by Uden (20 pp., 48 refs.); determination of organometallic compounds in environmental samples with element-specific detection by Irgolic (28 pp., 68 refs.); chromatography sample introduction for plasma mass spectrometry by Heitkemper and Caruso (25 pp., 100 refs.); the future of intelligent spectrometers in speciation by atomic emission spectrometry by Bilborn, Pomeroy and Denton (25 pp., 51 refs.); inductively coupled plasma mass spectrometry for element-selective detection in liquid chromatography by Houk and Jiang (22 pp., 67 refs.); the use of complexing eluents for the high-performance liquid chromatographic determination of metal species by Karcher and Krull (44 pp., 40 refs.); instrumentation and procedures for the long-term monitoring of metal ions in industrial effluents by liquid chromatography with electrochemical detection by Bond (45 pp., 69 refs.); ion chromatographic speciation of trace metals by Gjerde and Mehra (25 pp., 85 refs.); and interfacing of GC-HPLC with direct current plasma (DCP) emission spectroscopic detection for trace metal analysis and speciation by Krull and Childress (49 pp., 76 refs.).

In terms of applications to elements, the interfacing of chromatography with atomic and mass spectrometry not unexpectedly focuses on the analytical speciation (especially of the organometallic forms) of tin, lead, mercury, selenium and arsenic. Irgolic's chapter is especially good on the last of these and also contains a thoughtful half a page on the ambiguities associated with the term 'speciation'. He accepts that the term is most useful in the operational (analytical) sense but would prefer the use of substitute terms such as assembly of species, species distribution, transformation of species and determination of trace element compounds to convey exact meaning.

Other elements, such as cadmium, chromium, cobalt, copper, iron, nickel, vanadium and zinc, are not ignored, however, with particularly strong representation in the chapters on liquid chromatography. The inclusion of electrochemical detection, for example in Bond's description of automated on-line monitoring procedures based upon the formation, chromatographic separation and amperometric detection of metal ions as their dithiocarbamate complexes, is especially encouraging.

The book is well-produced in the style of the *Journal of Chromatography*, it contains 111 figures and has in a helpful way noted, at the foot of each right-hand page, the location of the reference pages for each chapter. It is a pity (and a surprising inconsistency) that in only one chapter does the reference section include the titles of the individual references.

This book can be highly recommended and not merely for its technical excellence and relevance. On page 2, Uden writes 'To the chromatographer, the spectrometer is a sophisticated 'chromatographic detector'; from the spectroscopist's point of view, the chromatograph is a component-resolving sample introduction device'. The ensuing pages of the book amply illustrate the benefits that can accrue from effective co-operation between sub-disciplines and practitioners prepared to take a broader, more holistic view of their subject and of the world.

John G. Farmer

Stationary Phases in Gas Chromatography

Edited by H. Rotzsche. *Journal of Chromatography Library*. Volume 48. Pp. xiv + 410. Elsevier. 1991. Price US\$166.50; Dfl 324.00. ISBN 0-444-98733-9.

The stated aims of this volume are to familiarize the analyst with the numerous stationary phases available for use in gas chromatography and the main column types, to give an understanding of the physicochemical behaviour of phases and the processes occurring in the separation column, to identify the advantages and disadvantages of stationary phases and to provide the knowledge that will enable chemists and biologists to select an appropriate column for a particular analysis. In the reviewer's opinion, the author has achieved these objectives in a text that should prove to be useful to both the beginner and the experienced chromatographer.

The book consists of eight chapters, which range from the basic concepts of gas chromatography through to guidelines for phase selection. These are supported by a comprehensive bibliography that cites 1167 references together with author, subject and stationary phase indices.

The concepts of gas-liquid chromatography are discussed in Chapter 2, which follows a one page introduction to the book which is designated Chapter 1. The raw data given by a chromatogram is taken as the starting point and the theoretical treatment is developed along two lines. In the first, retention parameters and their relationship with the distribution process occurring in an analytical column are considered together with the thermodynamics of gas chromatography and phase selectivity. The second deals with factors affecting peak dispersion

in both packed and capillary columns. Finally the two themes are pulled together through a treatment of resolution and quality of separation. The chapter is concluded by an invaluable compendium of symbols, equations and definitions.

The next chapter is concerned with the construction and contents of the chromatographic column and the steps necessary to ensure satisfactory analytical performance. Packed and capillary columns are treated separately. In each case, the properties of the various materials of construction are reviewed along with information on surface pre-treatment and stationary phase coating and immobilization procedures. A feature of this chapter is the wealth of practical information given, which should enable readers, if not already doing so, to prepare their own columns with confidence.

Stationary phase selectivity and column characterization are considered in Chapter 4, which opens with a review of the intermolecular forces involved in retention. Much of the discussion is centred on Kovats' retention index and its variants. The treatment of retention index is reasonably comprehensive, however, its limitations in phase characterization are not made clear. Thermodynamic criteria also are discussed in what some readers may consider to be a rather specialized chapter of limited practical value.

The next two chapters deal with column packings intended mainly for use in gas-solid chromatography. In the first of these chapters various adsorbents, including carbon, silica, alumina, zeolites and organic polymers, are described along with comprehensive treatment of their analytical applications. This is followed by a consideration of chemically bonded phases, information that is useful but adequately covered elsewhere, in particular in the myriad of texts on liquid chromatography.

Notwithstanding the current enthusiasm for capillary columns, the packed variety are still widely used by analysts. Therefore, it is appropriate that a section of the book should be devoted to the column packing. In Chapter 7 an extensive account of the preparation, properties and application of materials used as the support phase is presented. Although mainly concerned with diatomaceous materials, and steps that can be taken to improve their performance, specialist supports are not neglected.

A comprehensive account of the chemical, chromatographic and physical properties of stationary phases is given in Chapter 8, which represents about one quarter of the text. Materials covered include hydrocarbons, silicones, alcohols, ethers, esters, amines, amides, nitriles, sulfur compounds, fatty acids and their salts, fluoro-compounds, chiral phases and liquid crystals. A wealth of information is presented. This part of the book is highly recommended to all workers interested in phase selectivity.

The final chapter consists of a brief account of the factors affecting the choice of a stationary phase for a particular analysis. This is supported by lists of commercially available phases, along with trade names, and selectivity data, including Rohrschneider and McReynolds constants.

The book is recommended.

M. B. Evans

Capillary Chromatography—The Applications

Edited by Walter G. Jennings and John G. Nikelly. Pp. vii + 153. Hüthig. 1991. Price DM88.00. ISBN 3-7785-2051-2.

The introduction into the analytical laboratory of fused silica capillary columns for gas chromatography over the past decade has resulted in numerous applications of the technique, and as a consequence several texts have already appeared dealing with the subject. This short ten chapter book is the latest to be published by Hüthig (as part of their

Chromatographic Methods series under the overall editorship of W. Bertsch, W. G. Jennings and P. Sandra) in this area.

The bulk of the book is concerned with environmental applications of capillary gas chromatography. Chapters 1 and 4 concern the analysis of organochlorine and organophosphorus pesticides using megabore rather than capillary type columns. Both articles provide useful chromatographic information on column selection, retention times, recovery data and choice of detector for the various compound types. Chapters 5, 6 and 7 deal with the analysis of tobacco smoke constituents, toxic volatile organic compounds and parent and nitropolycyclic aromatic hydrocarbons in ambient air samples respectively. The effects of stationary phase, column diameter and film thickness on the separation of these compounds are discussed. Chapter 2 is of particular interest and gives an account of how, using a multidimensional computer model, stationary phases can be made (by the combination of polymers containing specific functional groups) to give unique resolving properties; in this case applied to the separation of specific dioxin and dibenzofuran isomers. Two other sections provide a change in direction and describe the capillary gas chromatographic separation of trichothecene mycotoxins and amphetamine based drugs either as trimethylsilyl or trifluoroacetyl derivatives. The final article deals with liquid chromatographic-mass spectrometric applications rather than gas chromatographic and its inclusion in a book of this size and type appears to be a little strange. All the chapters generally have modern references.

A major criticism is that the text contains innumerable typographic errors (five on p. 56 and p. 63 alone) and one wonders whether the Editors read the manuscript before going to press. An index would also have been useful even in a book of this length.

Overall, the book attempts to cover too many different applications in a limited space and therefore becomes only of general interest to any one gas chromatographer. Possibly the publishers would have been better advised to have devoted separate volumes to environmental applications of gas chromatography, clinical applications of gas chromatography, etc.

G. A. Mills

Analytical Raman Spectroscopy

Edited by Jeanette G. Grasselli and Bernard J. Bulkin. Volume 114 in *Chemical Analysis: A Series of Monographs on Analytical Chemistry and its Applications*. Series Editor, J. D. Winefordner. Pp. xviii + 462. Wiley, 1991. Price £67.00. ISBN 0-471-51955-3.

Contrary to what might have been anticipated Fourier-transform (FT) Raman spectroscopy occupies only a small place in this book. Nevertheless, with the major boost given to the use of Raman spectroscopy for analytical work by the emergence of the FT-type spectrometer the appearance of this book is very timely. It is a *vade-mecum* for those with some experience and will prove invaluable for those who are contemplating entering the field. The authors of the 12 chapters are all seasoned practitioners, some with academic backgrounds, the others with wide industrial analytical experience, and they write with authority.

Following a brief but lucid introductory chapter, which contains a useful table of characteristic Raman frequencies for structural diagnostic studies, there follow two chapters covering instrumentation and techniques and, specifically, polarization measurements. This latter is not central to the main theme of the book although some readers will doubtless find it useful. The chapter on inorganic species in solution has a reasonably broad coverage despite the fact that almost one third of the publications cited relate to the work of one of the authors. It also gives a useful account of some more

specialized quantitative techniques, particularly curve fitting and factor analysis. The succeeding chapter deals more generally with the scope and limitations of quantitative work with dispersive spectrometers. It provides a fair assessment of the present position, one that will change quite rapidly because of the quantitative capabilities of the FT-type spectrometer.

The substantial chapter on the characterization of semiconductors will be particularly useful for those entering the field, both for the theoretical background provided and for the broad general survey of published work. The short chapter headed polymer applications is, perhaps, a trifle misleading. The fact that it only cites 23 references indicates that this important topic is surveyed very selectively, in order to illustrate the general approach to polymer characterization. The same criticism can be levelled against an equally short chapter on uni-axially oriented polymers, which deals only with polarization measurements as an aid to vibrational mode assignments and ignores the determination of orientation functions.

However, the value of Raman spectroscopy for polymer characterization comes across very clearly in the chapter on organic and petrochemical applications. This account, with ample references, will be of considerable value to many industrial spectroscopists. This is also true for the chapter on catalyst studies, a *tour de force*, which runs to 70 pages, 350 references, and is both comprehensive and lucid.

The two final chapters are very contrasting. The penultimate one covers biological applications, where the technique has already made its mark and will do so increasingly in the future. This chapter provides a relatively brief but fascinating account of the diverse applications and should stimulate potential users. The book concludes, appropriately perhaps, slightly speculatively with an account of the chemical application of gas-phase Raman spectroscopy, which can be very useful in certain circumstances, and where the future may bring wider applications.

W. F. Maddams

Analysis of Microelectronic Materials and Devices

Edited by M. Grasserbauer and H. W. Werner. Pp. xlvi + 934. Wiley, 1991. Price £110.00. ISBN 0-471-91713-3.

More often than not the experimentalist longs for a single book, which is at the same time comprehensive, informative, readable and handy to use in the laboratory concerned as a ready reference that draws together a diverse range of techniques and methods.

This book is one such. Indeed, the editors and chapter authors are to be congratulated. They have done exceptionally well in providing, with marked uniformity of coverage, style and high quality presentation, what is necessary for the meaningful application of virtually all those techniques and methods pertinent to the analysis of microelectronic materials and devices. The contents, while addressing a particular business sector, offer much to the specialist and non-specialist alike who, as readers, may well have interests outside the microelectronics industry.

The contents, chapter by chapter, cover the essential principles, methodology, experimental constraints and application of some 35 techniques, some in common use, some less so. The end of each chapter also includes in summary form just what needs to be known about the particular method concerned to assess its relevance to a given problem. In addition, the text is supported by a better than usual index.

Section by section, the contents cover Bulk Analysis of Microelectronic Materials (5 chapters), Analysis of Surfaces, Interfaces and Thin Films (15 chapters), Structural Analysis on an Atomic Scale (4 chapters) and Physical, Electrical and Geometrical Characterization (11 chapters). Moreover, the

book has a useful introduction containing an instructive survey of the development of the microelectronics industry and a helpful outline of the methods referred to in the remainder of the book.

Overall, this long book (~1000 pages) is excellent value and, notwithstanding the present financial constraints affecting everyone, because of its comprehensive nature and ease of use it deserves a place in every materials science and surface science laboratory even where the local emphasis is not focused on microelectronics or related technologies or even on analysis. Indeed, the reviewer's copy has had to be retrieved from colleagues more than once in the course of reading through it.

N. M. D. Brown

Protein Purification: Design and Scale Up of Downstream Processing

By Scott M. Wheelwright. Pp. xvii + 228. Hanser. 1991. Price DM124.00; US \$83.60; £49.00. ISBN 3-446-15703-4 (Hanser); 0-19-520913-3 (Oxford University Press).

This text is unique in that the author attempts to cover protein purification both from the perspective of the biochemist and from that of the biochemical engineer. The book will therefore be useful for students of either discipline with an interest in biotechnology. The theme of industrial application is apparent from the first chapter on 'Process Design and Competitive Advantage' through to a final chapter that discusses the commercial processes for the isolation of various therapeutic proteins and other proteins of industrial importance.

The scope of the subject matter is ambitious attempting to cover all the component disciplines of bioseparation science and as the book itself is only 228 pages in length, the treatment of many topics is understandably superficial. The author tries to compensate for this size constraint by listing key references and texts for further reading at the end of each chapter. The success of this book therefore stands or falls by the clarity by which each subject is introduced and the value of the bibliography as a guide to the specialist literature. The book is intelligibly written and many of the new issues facing the new biotechnology industry are clearly spelt out. The bibliography is however of variable utility and many of the references could hardly be described as essential reading, *e.g.*, p. 170 "Anonymous, 'Ion exchange chromatography . . . principles and methods' Pharmacia, Uppsala, 1983".

Primary recovery is covered through chapters on cell disruption, centrifugation, precipitation and filtration. High resolution separations of proteins are covered in chapters on the major techniques of chromatography. These core chapters are accompanied by discussion of aspects of process design, protein structure and analysis, which are thin and largely superfluous, and a chapter of examples of processes selected from the published literature.

The size of the book has led to some notable omissions. In the primary recovery sections a description of the approaches to the recovery and solubilization techniques used in the industrial processing of recombinant *E. coli* inclusion bodies is lacking. As these techniques are critical to two of the large scale processes described in the final chapter this is unfortunate. The techniques of preparative electrophoresis, affinity precipitation, affinity membrane applications and large scale crystallization are also absent.

On the whole this book is a valuable addition to the limited library of books dealing with bioseparations. The book is unusual and successful in the treatment of a subject of such breadth and courageously attempts to define the subject both from a protein chemistry and from an engineering angle. It is not a bioseparation scientist's equivalent to Perry's Chemical Engineers Handbook but definitely is recommended reading for anyone wishing to obtain a rapid overview; in particular

students of biotechnology and junior research scientists in industry.

David R. Thatcher

Gas Chromatography in Air Pollution Analysis

By Viktor G. Berezkin and Yan S. Drugov. *Journal of Chromatography Library*. Volume 49. Pp. xii + 211. Elsevier. 1991. Price US \$140.00; Dfl 245.00. ISBN 0-444-98732-0.

This book is a detailed and comprehensive review of the use of gas chromatography in air pollution. It would be valuable reading for student and researcher alike and must be considered good value for money. It must be mentioned that the technology used in many of the examples throughout the book is not at the forefront of chromatographic technology; however, this does not invalidate the quality of the research discussed or undermine the value of the book. There is considerable detail of the theory of chromatography and of the chemical and physical properties of air pollutants.

The sections on sampling are of particular importance. Whether a pollutant is present in gaseous form, as an aerosol or as particulate matter is not always easily discernible. Vaporization may occur in aerosol traps and some pollutants may be adsorbed onto particulate matter rather than being present as actual particles. The authors clearly recognize the importance of choosing the correct sampling technique and have devoted the largest chapter in the book to sampling methods.

Chapter 6, the review of reactive-sorption concentration (RSC), will be of special interest to those researchers interested in analysing compounds that may interact with other pollutants or where greater specificity is required. The authors claim that this technique will greatly increase the potential of gas chromatography in the analysis of air pollutants improving identification and reliability.

The scope of the subject is such that a single book would be unlikely to cover the full range of possible air pollutants in great detail but this volume makes an admirable attempt. The techniques are similar for any potential pollutant and thus, even if a particular researcher's compounds of interest are not included, that should not preclude the possible purchase of this volume.

E. G. Cotterill

CRC Handbook of Chemistry and Physics. 72nd Edition

Editor-in-Chief, David R. Lide. Pp. 2472. CRC Press. 1991. Price £70.00. ISBN 0-8493-0472-5.

The 71st Edition of this long-running serial was completely revamped, being organized into 16 sections plus an appendix of mathematical tables. This arrangement has been retained for the 72nd Edition. The sections are as follows: Basic Constants, Units and Conversion Factors; Nomenclature, Symbols and Terminology; Physical Constants of Organic Compounds; Properties of the Elements and Inorganic Compounds; Thermodynamics; Electrochemistry and Kinetics; Fluid Properties; Biochemistry and Nutrition; Analytical Chemistry; Molecular Structure and Spectroscopy; Atomic, Molecular and Optical Physics; Nuclear and Particle Physics; Properties of Solids; Polymer Properties; Geophysics, Astronomy and Acoustics; Practical Laboratory Data; Health and Safety Information; Mathematical Tables; and CAS Registry Numbers and Molecular Formulae of Common Chemical Substances.

Each section is, as usual, crammed with data and the binding is (again as usual) very durable. The book represents amazingly good value for money.

R. A. Young