Book Reviews

Works intended for notice in this column should be sent direct to the Book-Review Editor (R. O. Gould, Department of Chemistry, University of Edinburgh, West Mains Road, Edinburgh EH9 3JJ, Scotland). As far as practicable books will be reviewed in a country different from that of publication.

J. Appl. Cryst. (1991). **24**, 265

Crystal engineering: the design of organic solids.

By *G. R. Desiraju*. Pp. xiv + 312. Amsterdam and New York: Elsevier Scientific Publishers, 1989. Price Dfl 220.00 or US $115.75.

In his preface to this book, Professor Desiraju notes the lack of interaction between the three groups of workers at which he aims the volume: organic chemists and materials scientists involved in purposeful crystal design, theoreticians interested in intermolecular interactions and crystallographers searching for patterns in crystal structures. He attempts to bridge the gaps between these groups by pooling research results in all three areas to draw conclusions as to the nature of crystal structure determining forces and their use in 'crystal engineering', a term he credits G. M. J. Schmidt with coining.

The book opens with a chapter which neatly sets out the author's aims and explains the motives behind the discipline of crystal structure design. The emphasis here is very much on topochemical solid-state reactions, although some mention is made of non-linear optics and molecular conductivity. Crystal morphology and the reasoning behind possible needs to influence it are not covered here sadly, although brief reference is made in later chapters to the work of Lahav and Leiserowitz in this area. The book then continues with largely non-mathematical descriptions of the computational and statistical methods of crystal structure prediction. A fairly lengthy description of the Cambridge Structural Database (up to version 3, January 1989 update) is perhaps unavoidable here, but dates the book.

Chapters 4 to 7 consist of examples of structures illustrating the effect of isotropic van der Waals and the more directionally specific hetero-atom interactions in determining crystal structures. The examples are well chosen and illustrated, with a variety of diagrams and stereo drawings of structures that bring the author's points over clearly. The importance of the hydrogen bond is strongly emphasized; the chapter dealing with it is the longest in the book! Chapters 8 and 9 cover the design of crystal structures for specific purposes, such as non-centrosymmetric crystals for non-linear optics, and tailored clathrates. A particularly interesting example here, and in the earlier chapter about sulfur–sulfur interactions, is that of the role of such interactions in determining the stack and sheet structures of the so-called organic metals.

Polymorphism, described as 'the Nemesis of crystal design?', is discussed in the final main chapter, which is disappointingly short at only 16 pages. This seems to underestimate the importance of the phenomenon, although the author has clearly resisted the temptation to sweep it under the carpet entirely. Polymorphism, while adding to our understanding of the balance between intermolecular interactions, makes crystal design very much an imprecise discipline.

In his final conclusions, the author comments that the relationships between crystal structure and properties such as solvation, ease of growth and morphological quality are largely uncharted waters. Much research effort is currently being employed in these areas, so perhaps, in ten years time, the rather vague conclusion that crystal engineering is still something of a black art may be replaced by a more firm strategem for the discipline. However, Professor Desiraju has succeeded in pulling together evidence from various different fields to aid the would-be crystal engineer in a useful text that builds on the earlier works of Kitaigorodski.

STEPHEN J. MAGINN

ICI Chemicals & Polymers Ltd
PO Box 8
The Heath
Runcorn WA7 4QD
England

J. Appl. Cryst. (1991). **24**, 265–266

A guide to materials characterisation and chemical analysis.

By *John P. Sibilia*. Pp. x + 318. VCH Verlagsgesellschaft, Weinheim, 1988. Price DM 75.00, £25.95.

This book is of manageable length and yet contains 13 chapters in which approximately 75 techniques and general methodologies are described. Its general layout is methodical and pleasing. The introductory chapter explains how one might proceed in utilizing the techniques described in the subsequent chapters. Each chapter in turn describes the use, sample requirements, principle, some typical applications, limitations and some general references for the respective techniques.

The chapter headings with their subdivisions in parentheses are as follows: *Molecular spectroscopy* (IR, Raman, UV, Vis, NIR, NMR [Solution, Solid, 2-D], EPR); *Mass spectrometry* (Low & high resolution, GC-MS, HPLC-MS, FAB, Tandem MS); *Chromatography* (GC, LC[HPLC], SFC, Ion-C, GPC); *Chemical analysis, electrochemistry and atomic spectroscopy* (Classical chemical analysis, Functional groups, Combustion, Ion-selective electrodes, Radioactive tracer, Polarography and voltammetry, Isotachophoresis, AAS, ES, Flame emission, ICP-AES, NAA); *X-ray analysis* (Powder diffraction, Polymer diffraction, SAXS, SANS, EXAFS, XANES, XRF, Synchrotron sources); *Microscopy* (Optical microscopy, SEM/EPMA, STEM/TEM, Automatic image analysis, Microscopy specimen preparation techniques); *Surface analysis* (XPS, SAM, SIMS, UPS, BIS, ADXPS, STM); *Thermal analysis* (TGA, DTA, DSC, TMA, Dilatometry, Thermal conductivity, DMA and sonic modulus, DETA); *Viscosity & molecular weight of polymers* (Rheology, Mechanical spectrometry, Molecular weight, Colligative properties, Viscosities, Classical light scattering, Crosslink density, Field flow fractionation); *Physical properties of particles and polymers* (General methods for particle size analysis, Photon correlation spectroscopy, Gas absorption, Mercury intrusion porosimetry, Cohesive energy density, Surface energy of solids, Dilatometry); *Physical testing* (Mechanical properties of materials, Fatigue testing, Instrumented impact analysis, Fracture toughness of materials, Gas & liquid permeability); *Scientific computation* (applied finite element analysis, Computational fluid dynamics modelling, Dynamic and steady state material process modelling, Molecular modelling).

In the preface we are told that '...this book was written to provide a guide to anyone interested in the characterization of materials with emphasis on analysis of chemicals, polymers, ceramics, metals and composites. Its goal is to provide the novice or student with the salient features of modern materials characterization and analysis techniques. It is also aimed at providing a review for the experienced investigator and expanding the scope of knowledge of those experienced in only a number of characterization techniques...'.

This is quite a bold statement indeed, and anyone attempting to produce such a book must be well aware of the pitfalls. Happily John Sibilia has avoided the temptation to produce an enormous

volume which would have been well beyond the patience (and pocket) of the majority of potential readers. Instead he has compiled a relatively slim publication and in it attempted to pack as much information as he and his co-authors can, at a level which should be comprehensible to advanced undergraduates, post-graduates and industrial chemists alike.

In doing so, however, he must have been prepared to accept the inevitable result, namely that some topics simply cannot be described adequately in one or two pages, and that a reader may be left frustrated and annoyed by the lack of information. Fortunately chapters of this type are in the minority and Sibilia's gamble has paid off. The majority of chapters are well written, containing crisp line diagrams and photographs (non-glossy) of reasonable quality.

The highlight of the introductory chapter is the section on problem solving or 'trouble-shooting'. Examples are drawn from the polymer industry (delamination in food packaging film) and the semiconductor industry (failure of a thick resistor in a sensor circuit). The way in which these problems were tackled, the variety of analytical techniques which were used, and the conclusions reached make excellent reading and whet the appetite for the rest of the book.

Of the 12 chapters, chapter 5 (*Chemical analysis, electrochemistry and atomic spectroscopy*) is the one for which most criticism is reserved. It is 27 pages long but it covers no fewer than 12 different topics. Not only are there 12 topics but the range of topics is far too great for one chapter and this is its downfall. Contrast this with chapters 2 (*Molecular spectroscopy*), 7 (*Microscopy*) and 8 (*Surface analysis*) whose respective lengths are 27, 26 and 33 pages but which contain sections that are closely related and follow on naturally from one to the next. They are well written, whereas the feeling one gets after reading chapter 5 is that a number of analytical techniques were left over and could not be fitted into any other chapter so they were combined. This is a pity because the sections on AAS, ES, flame emission, and ICP-AES could have been usefully expanded and used to form a chapter on their own. The same could be said for ion-selective electrode analysis, radioactive tracer analysis, polarography and voltammetry, and isotachophoresis. Classical chemical analysis, functional group analysis and combustion analysis could have been relegated to an appendix, and neutron activation analysis (NAA) could have been incorporated in the X-ray analysis chapter.

The layout of chapter 5 is the one failing in this book. All other criticisms are minor. In chapter 6 (*X-ray analysis*) no mention whatever is made of X-ray powder photography which still has an important role to play in the analysis of microgram-sized samples – in particular metallic specimens which diffract strongly in the back-reflexion region. The section on synchrotron X-ray sources is too short for such an important topic.

There are a small number of typographical errors and other more irritating grammatical errors *e.g.* 'comprised of' and 'it's' instead of 'its'. On p.282 in the text Figure 2 is incorrectly referred to as Fig. 1, and on p.173 the In/Pb ratios from XPS spectra on fresh and aged metal foils have been transposed.

In summary this book is attractive and well produced, it is pitched at the correct level for its intended readership and, with the exception of chapter 5, a pleasure to read. It also represents good value for money.

DAVID F. RENDLE

Metropolitan Police Forensic Science Laboratory
109 *Lambeth Road*
London SE1 7LP
England

J. Appl. Cryst. (1991). **24**, 266

Monteregian treasures. By *J. A. Mandarino* and *V. Anderson.* Pp. xiii + 281. Cambridge University Press, 1989. Price £60.00, US$ 85.00. ISBN 052132632X.

The title *Monteregian treasures* and the appearance suggest a 'coffee-table' book, and indeed it contains the wealth of beautiful colour photographs one might expect in such a book. But there is much more besides. The book is a classic of topograhical descriptive mineralogy, reviewing their available information on the minerals of a particular area, a type of book which seems to be enjoying a welcome revival after a long lapse from popularity.

Mont Saint-Hilaire, one of the Monteregian Hills about 40 km east of Montreal, is one of the mineralogical treasure troves of the world. It has yielded some of the most remarkable and beautiful mineral specimens and many examples of rare species. The book brings together for the first time the known data on the 221 mineral species found at Mont Saint-Hilaire which include examples of many rare carbonates and silicates.

The book begins with an introduction to the geology, petrology and geochemistry of the area; the minerals which occur there, their chemical classes and the different types of geological environment in which they occur. The main part of the book is devoted to the description of each of the minerals found at Mont Saint-Hilaire and covers *Form and habit, Physical properties, Occurrence and associated minerals, Optical properties, Chemical data, Crystallographic data* and *Distinguishing features.* There are coloured or black-and-white photomicrographs to illustrate the habit of many of the minerals described. Appendices contain (*A*) single-crystal data arranged in alphabetical order of mineral species and in 'Crystal Data' order by crystal system and axial ratios; (*B*) powder diffraction data (six strongest lines) in order of mineral species and in Hanawalt order; (*C*) mineral occurrences in the different types of geological environment; (*D*) mineral species by chemical classification; (*E*) chemical analyses of the minerals.

The book is a most comprehensive reference work: the mineral collectors and museum workers for whom it must be mainly intended will find it invaluable as an aid to mineral identification and as a source of data on the rarer minerals generally. Mineralogists are fortunate that their subject allows them a reference book like this, whose clarity of layout and colour photographs will make it a delight to use or just look through.

JAMES E. CHISHOLM

Mineralogy Department
British Museum of Natural History
Cromwell Road
London SW7 5BD
England