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.

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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.

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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