APPLIED ORGANOMETALLIC CHEMISTRY
Appl. Organometal. Chem. **14**, 227–228 (2000)

Book reviews

The Heavier d-Block Metals: Aspects of Inorganic and Coordination Chemistry Oxford Chemistry Primers No. 73

C. E. Housecroft
Oxford University Press, Oxford, 1999
96 pages. £5.99
ISBN 0-19-850103-X

Catherine Housecroft's latest addition to the *Oxford Primer Series* (OPS) is a timely replacement for Cotton and Hart's *The Heavy Transition Elements*, now over 20 years old, and is designed to complement both Winter's d-*Block Chemistry* (OPS No. 27) and her own *Metal–Metal Bonded Carbonyl Dimers and Clusters* (OPS No. 44).

The book is divided into sections covering aspects of periodicity, aqueous ion chemistry, structure of coordination complexes, magnetic and electronic properties, multiply bonded complexes, and finally has two chapters devoted to high-valent clusters and polyoxometallates. After a brief introduction, each chapter surveys the behaviour of the elements by group, with an excellent selection of examples ranging from the classical to the exotic. Many key issues in coordination chemistry are addressed and a variety of applications discussed, but much of the focus is on individual aspects of chemistry.

The principal weakness of this text lies in the chapter on electronic structure and magnetism. While the concise format of these primers precludes in-depth discussion, this chapter is quite disappointing. Four pages are devoted to the usual material, found also in Winter's book, on crystal field splittings and the magnetic behaviour of square-planar compared with tetrahedral nickel complexes. Curiously, in this context, no explanation is given for the absence of tetrahedral complexes of palladium and platinum, for example. Equally, the discussion of Kotani diagrams makes no reference to the importance of T ground terms and the existence of low-lying excited states. In this respect Nicholl's classic *Complexes and First-row Transition Elements* (David Nicholls, MacMillan 1975) is rather more sophisticated. The two pages on spectroscopy are also extremely elementary, with no mention of term symbols or of any of the effects which give rise to fine structure or complexity in the spectra of these complexes.

Another quibble is that redox behaviour of the metal ions in solution is only described in terms of Latimer diagrams. Whilst these are essential for making quantitative statements, the visual impact of the Frost diagram is far more effective for illustrating pH- or ligand-dependent behaviour.

As with all the primers, the tight budget means that less attention is devoted to the details of typography and layout. Some of the typefaces are inconsistent and the kerning of characters is left to the vagaries of the typesetting software, making the book less easy on the eye than one would like. The chemical diagrams, some of which are unnecessarily large or are repeated several times with minor differences (e.g. the octahedral core halide clusters), also leave much to be desired: there are clumsy spacings between bonds, odd misalignments of bonds and atoms, and confusing overlaps of the foreground and background, — minor individual points which cumulatively detract from the 'look' and 'feel' of the book.

In summary, therefore, this volume provides a good introduction to the descriptive chemistry of these varied and fascinating elements, but dwells unduly on the examples while not really capturing the broad sweep of the subject. Theory is not its strong point. Hence it should be recommended as an optional supplementary text for intermediate-level students of inorganic chemistry.

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Basic Solid State Chemistry

Anthony R. West
2nd edn. John Wiley and Sons, Chichester, 1999
xvi + 480 pages. £24.95
ISBN 0-471-98756-5 (pbk)

This book is the second edition of the excellent text first published in 1984. It provides a well-rounded view of solid-state science and will find widespread appeal to undergraduate and postgraduate students in chemistry, materials science and condensed-matter physics. It is well produced with clear line diagrams and is extremely easy to read. Separate sections can be read in isolation from others, without prior knowledge.

The first three chapters cover structural aspects of solid-state chemistry, from crystal structures, through bonding in crystals, to diffraction techniques. These chapters have been revised to include a description of fullerenes and graphite. Chapter 3 details crystallography and diffraction techniques primarily based on X-rays, but some coverage of neutron and electron diffraction is included at the end of the chapter. The author has not pulled away from presenting a mathematical description of structure factors. However, his style and care in presenting the material allows the reader to follow his arguments with clarity. Occasionally the style of presentation becomes semi-empirical: where this is the case, the author has gone to the trouble of specifically pointing it out and giving references to more advanced texts.

Chapter 4 details a wide variety of microscopy (optical, electron), spectroscopy (IR, Raman, UV/Vis, NMR, ESR, XRF, EXAFS, XPS, UPS, AES, Mössbauer) and thermal analysis (TG, DTA, DSC) techniques. The author gives a flavour of each of the techniques, and indicates the

physical basis of the method and how that technique can be applied to the analysis of solid-state materials. The coverage is not extensive but does serve as an extremely useful guide.

Chapter 5 details aspects of defects in crystals and solid solutions. Chapter 6 shows how phase diagrams can be interpreted. Both chapters are intelligently written and will serve as an excellent introduction for an undergraduate student.

Chapter 7 is concerned with electrical properties of materials. It covers a wide range of topics, from superconductivity, through organic metals, charge-transfer complexes, fullerides, semiconductors and ionic conductors, to solid electrolytes. The coverage is quite extensive and includes numerous examples of the utilization of solid-state chemistry in commercial devices. This chapter, in particular the sections detailing the use of solid-state batteries, has been completely rewritten since the first edition.

Chapter 8 details the magnetic and optical properties of solid-state materials.

Chapter 9 is a new chapter. It covers one of the main omissions of the first edition — how solid state materials are made. The traditional 'heat and beat' ceramic method and the various *chimie douce* approaches to synthesis are explained with clarity. Some of the basic aspects of forming thin films via CVD, electroplating, sputtering and laser ablation are covered. So too are aspects of combustion synthesis (SHS, SSM) and crystal growth.

The Further Reading section gives references to books, original papers and reviews related to the various chapters. This information has been updated to include 1999 publications. A set of questions and a comprehensive index round off the book.

I have only two minor criticisms of this book. The first is that answers to the set questions are not provided. Inclusion of this material, at least in part, would certainly help students and give them a form of self-assessment. It should be noted, however, that answers to the questions can be obtained by lecturers directly from the author. The second criticism concerns the quality of the photographs in the book. Whilst the photographs are interesting (particularly the one of a Japanese lady being levitated on a YBaCuO superconductor), they are somewhat blurred and not of the reproductive quality of the line diagrams.

Overall this is an outstanding textbook. The first edition of the book firmly established itself as the market leader, and indeed in some respects a pioneer in grouping together solid-state chemistry into a distinct teaching entity. The second edition is even better. This is a 'must have' book for any undergraduate studying solid-state chemistry.

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N-centered Radicals Chemistry of Free Radicals, vol. x

Z. B. Alfassi (ed.)
John Wiley & Sons, Chichester, 1998
xi + 715 pages. £185
ISBN 0 471 96186 8

This is a further volume in Alfassi's series on the *Chemistry of Free Radicals*, the other titles to date being *General Aspects of the Chemistry of Free Radicals, Peroxyl Radicals* and *S-centered Radicals*. It follows the established pattern, in that little attempt is made at a comprehensive coverage of the subject, but a selection of authors contribute chapters on their special fields of interest. The first 12 of the 23 chapters are on NO_x radicals and their involvement in atmospheric and biological chemistry, but the nitroxyl radicals, $R_2NO\cdot$, which are important in spin-trapping and spin-labeling, are not specifically included.

The topics covered concerning the nitrogen oxide radicals are: reactions of NO· (G. Dorthe), $NO_2\cdot$ (B. Weiner and K. I. Bamhard) and $NO_3\cdot$ in the gas phase (G. Le Bras) and $NO_x\cdot$ in the atmosphere (C. A. Cantrell); reaction of $NO_2\cdot$ towards organic donors in the liquid phase (E. Bosch and J. K. Kochi) and in argon matrices (M. Nakata); experimental studies of the $NO_3\cdot$ radical (R. P. Wayne) and its reactions in aqueous solution (H. Hermann and R. Zellner) and in organic solvents (O. lto); $NO_2\cdot$ and $NO_3\cdot$ radicals in the radiolysis of nitric acid solutions (Y. Katsumura); $NO_2\cdot$ in biology (P. Wardmann); and the toxicity of nitrogen oxides (N. M. Elsayed).

The other chapters cover HN· radical reactions (W. Hack), reactions of $H_2N\cdot$ radicals in the gas phase (A. M. Mebel, L. V. Moskaleva and M. C. Lin) and in aqueous solution (Z. B. Alfassi, R. E. Huie and P. Neta), homolytic addition reactions of $R_2N\cdot$ radicals (B. J. Maxwell and J. Tsanaktsidis), anilinyl radicals and radical ions (G. Merényi and J. Lind); nitroarene and aromatic *N*-oxide radicals (P. Wardmann); imidyl (J. Lind and G. Merényi) and indolyl radicals (L. P. Candeias); OCN· and SCN· radicals (J. F. Hershberger) and their reactions in aqueous solution (Z. B. Alfassi); and the thermochemistry of N-centered radicals (D A. Armstrong).

All the contributions are authoritative and up to date, most covering the literature into at least 1996, and the subject index is good. All the volumes in this series would benefit from the inclusion of a foreword to set out the aims, and from tighter editing to improve the coverage and avoid overlaps; and as the coverage of the subject is incomplete, I would have appreciated a detailed list of the contents of the chapters. I would also like to see consistent representation of the unpaired electron in molecular formulae, which would help in electron book-keeping to avoid some of the errors that have escaped proof-reading.

I think the most useful function of this volume will be to give a fairly complete and up-to-date treatment of the chemistry of the NO_x radicals in the atmosphere and the environment.

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