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Book reviews

Theoretical foundations of molecular magnetism

By Roman Boca, in the Series, Current Methods in Inorganic Chemistry, vol. 1, Elsevier, Amsterdam, 1999, 874 pp. ISBN 0-444-50229-7 (hard bound); US$ 356.00

Magnetic properties are pervasive through material science and the subject area spans both chemistry and physics. This book is a magnificent attempt to bridge these areas and to introduce chemists, especially, to the beauty of the subject. In the early days of the renaissance of inorganic chemistry, magnetism (high spin, low spin etc. in ligand field theory) played a major role and was covered in some depth in the early books of Figgis, Ballhausen, Gerloch, Griffith etc. For many years, the field lay fairly dormant but more recently has revived with the search for molecular magnets, for materials with unusual magnetic properties such as spin frustration, and with the study of the magnetic exchange properties of large clusters etc. The time is therefore, ripe for the publication of a major work in the field, and Roman Boca has certainly provided an authoritative tome of near 900 pages. As Boca notes 'the mosaic of theoretical magnetochemistry has roots in the special theory of relativity, the theory of tensor operators, group theory, quantum mechanics, quantum chemistry, statistical thermodynamics, numerical mathematics etc.' A lot can be learned by reading this book!!

Chapter 1 provides almost 100 pages of the necessary mathematical background while the next two chapters deal with the macroscopic and microscopic magnetic properties and introduce the application of statistical thermodynamics. Chapter 4 introduces the relativistic approach leading in Chapter 5 to the evaluation of magnetic parameters and in Chapter 6 to the temperature dependence. Subsequent chapters deal with type of magnetism (ferri-, ferro- etc.), single magnetic centres, spin crossover, dinuclear and cluster systems. The single magnetic centre chapter (8) will probably be the most familiar to readers of the earlier cited books. Most of the rest of the book will be new and challenging for most chemists. The text is extremely rich in equations, averaging probably around six equations on every page. Curiously, these equations do not have individual identification numbers, so it is apparently not possible to refer back to any previous equation in the text except by its page location. Each chapter finishes with a summary of what has been covered, and a selection of key references. Appendicies include angular momentum matrices, formulae for 3j, 6j etc. symbols, Pascals constants (a much larger collection than usually presented) and some programme code. A very valuable book for anyone seriously studying the magnetic properties of materials.

PII: S0010-8545(02)00003-6

Main group chemistry

By A.G. Massey, 2nd ed., John Wiley & Sons Ltd., New York, 2000, 534 pp. ISBN 0-471-49037-7 (HB); 0-471-49039-3 (PB); US$ 110.00 Hard Bound

This book has no Preface but does have a detailed Introduction which introduces many of the major concepts in inorganic chemistry of main group relevance. 'Simple' things which every well grounded student should know, include solubility behavior (e.g. all nitrates are soluble, as are virtually all alkali metal and ammonium salts), methods of making simple salts (e.g. oxide plus acid!), synthesis of carbonates and hydrolysis (e.g. acidity of higher oxidation states and smaller ions, leading to loss of protons)—although the extension to very high oxidation ions, such as Mn(VII) forming oxyanions was curiously absent. Further topics included ligands, the chelate effect, a simple approach to stability constants but no extension to hard and soft. The chelate effect was exemplified through chelation therapy to remove toxic metals. The reaction of halogens with main group metals was considered (though the title of that section, Formation of Halides is surely misleading). Other topics included organo-element derivatives and inorganic nomenclature. All of this is covered in 20 pages. While it is a very useful Introduction, an opportunity was lost here to put more meat/detail into it and use more pages. Subsequent chapters deal with the chemistry of all the main group elements starting with Hydrogen. Emphasis is rightly placed on the position of the element in the Periodic table and comparisons with diagonally adjacent elements.

In the absence of a Preface, one does not know what this volume strives for. The major problem with main group chemistry is that far fewer physical techniques can readily be applied than for transition metal chemistry—but this is surely a reason to ensure that those technqiues that are applicable will be covered. This volume is highly descriptive with few physical data. For example, a table of electrode potentials is included in the Introduction, but

there appear very few mentions of potentials elsewhere (it is not an index item save for the Introduction)—e.g. what about the relative oxidizing strengths of the oxides of nitrogen (or phosphorus)—under acidic and basic conditions? NMR and photoelectron spectroscopy are briefly mentioned but not dealt with in any detail throughout the volume. Thermodynamic data appear from time to time—but not in great depth.

If a descriptive undergraduate main group text is the aim of this book, then it succeeds very well. As a text for the serious researcher, it falls short of what it might have been!

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Chemical bonding and molecular geometry

Edited by Ronald J. Gillespie and Paul L.A. Popelier, Oxford University Press, Oxford, UK, 2001. ISBN 0-19-510496-X; US$63.50, soft cover

Ronald Gillespie is a well established inorganic chemist best known to undergraduates through the introduction of VSEPR theory permitting the easy prediction of the geometries of a very large number of inorganic species. More recently he has explored the ligand close packing model (LCP) to elucidate problems in geometry. Teamed up with Paul Popelier, author of "Atoms in Molecules" these specialists have written an authoritative volume to provide students with a comprehensive and detailed introduction to the principal models and theories of chemical bonding and geometry. This book is a 'must read' for any serious researcher interested in the shapes of molecules and the forces, which hold them together. Written in an easy style, the first few chapters dealing with bonding, fundamental aspects of quantum mechanics and VSEPR will be readily recognised and understood by senior undergraduates. This is followed in Chapter 5 by a discussion of the role of ligand–ligand repulsion in the LCP model. Chapter 6 deals with electron density and the Atoms in Molecules (AIM) theory and moves us to a somewhat higher level leading to the Laplacian of the Electron Density (Chapter 7). This is a very useful function, which reveals where the electron density is locally concentrated or depleted. The utility of the Laplacian is explained in a readable style in this chapter.

The final two chapters contain a large number of molecules for discussion using the previously introduced theories. Chapters have further reading references.

PII: S0010-8545(02)00005-X

Homogenous catalysis—mechanisms and industrial applications

Edited by Sumit Bhaduri and Doble Mukesh, Wiley-Interscience, New York, 2000, 239 pp. ISBN 0-471-37221-8; US$79.95, hard bound

This book grew out of a graduate level lecture course given by one of the authors at Northwestern University. It is pedagogical and selective rather than comprehensive. An objective was to draw a link between fundamental research and its successful commercial application. It is unusual for a chemistry book, to have a section devoted to the engineering aspects of the utilization of industrial catalysis. There are nine chapters dealing, inter alia, with chemical engineering fundamentals, carbonylation, hydroformylation, polymerization, alkene-based catalysis, oxidation and asymmetric catalysis. Useful from the course viewpoint is the presence of a set of questions/problems at the end of each chapter, some with answers provided, plus citations for further reading.

PII: S0010-8545(02)00006-1

Manganese and its role in biological processes, vol. 37 in the series metal ions in biological systems

Edited by Astrid and Helmut Sigel, Marcel Dekker, New York, 2000, 761 pp. ISBN 0-8247-0288-3; US$250.00, Hard Bound

Probing of proteins by metal ions and their low-molecular-weight complexes, vol. 38 in the series metal ions in biological systems

Edited by Astrid and Helmut Sigel, Marcel Dekker, New York, 2000, 690 pp. ISBN 0-8247-0289-1; US$250.00, Hard Bound

These volumes continue the excellent series edited by the Sigels, begun in 1973, required reading for researchers in the bioinorganic and biomedical fields and valuable editions to their bookshelves. Both follow the usual pattern of bringing together world experts to write authoritative chapters.

Volume 37 focuses on manganese with 20 chapters covering such diverse areas as the uptake of Mn in microorganisms and plants, the role played by manganese in carbohydrate recognition in plants, a survey of the proteins which contain Mn, reports on manganese isomerases, dioxygenases, catalases, peroxidases and, of course, superoxide dismutases. Its role in photosynthesis is also, obviously, covered in some depth. In reading through the book, it is evident that physical methods, especially X-ray methods and electron paramagnetic resonance techniques have been extremely important recently in elucidating the role that manganese plays.

Volume 38 has three main sections in 15 chapters. The breakdown of proteins via amide hydrolysis is very difficult due to the inherent stability of the amide