

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. Appendices 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.

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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 oxanions 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 techniques 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