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Book reviews

The chemistry of pollution

G. Fellenberg
John Wiley & Sons, Chichester, 2000
x + 192 pages. £24.95 (paperback)
ISBN 0-471-61391-6

This book has been translated from the German version, which is now in its third edition. Thus it is clearly a popular text in Germany, although it appears to have lost something in the translation. The use of English is strange in places and, in general, the text is very terse and often reads more like a review article in a journal than an academic textbook. In addition, the use of short paragraphs jumping between examples does not help the reader's understanding of many of the topics and sometimes distracts from the overall value of the chapter. In terms of contents, the book has a broad (ambitious) coverage, its strength being the chemistry rather than the superficial attempts to relate the material to more generic environmental issues. Indeed, Chapter 9, the last chapter in the book, entitled 'Outlook', with a length of less than a page, has very little value at all. But there is much information crammed into the 192 pages. The author attempts to cover the nature of pollution; atmospheric pollution; ground and surface waters; soil pollution; 'widespread materials'—PCBs, PAHs, organo pesticides; foodstuffs; and 'consumer goods'—using examples of cleaning agents, detergents, paints, cosmetics and toilet articles, and radioactivity.

This is fine as a book to dip into for a brief overview of chemical aspects of pollution from the above sources, although some areas do require some prior knowledge of chemistry to facilitate a full understanding. The frustrating part is that, having got started on a topic, the text stops. There are many examples throughout the book, but strangely there are absolutely no references! The literature listing at the back of the book (23 titles) of other associated texts are all apparently in German. Hence, the non-German speaking reader is left with a little knowledge of many topics, but without guidance as to further reading. This identifies the main problem with this text: it appears to be an almost word-for-word translation into English of a German text, written from the German viewpoint. There are a surprising number of typographical errors and most of the more specific examples (on river pollution, consent limits for gaseous pollutants in the workplace, dietary intake data etc.) relate directly to Germany. All of this distracts from the value of the book to a non-German reader. This is a pity, since clearly the subject matter is well researched and potentially offers an (albeit brief) overview of much appropriate and important pollution chemistry. Unfortunately, however, given its shortcomings, it is not a book that I could recommend without reservation to undergraduate students, although it does provide an interesting overview for those with a general interest in pollution chemistry.

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Ligand field theory and its applications

B. N. Figgis and M. A. Hitchman
Wiley–VCH, New York, 2000
xviii + 354 pages. £51.95
ISBN 0-471-31776-4

This book, planned as the first in a series (*Special Topics in Inorganic Chemistry*) of single-volume introductions to major areas of inorganic chemistry written by experts, sets a high standard for that series. Its senior author, Brian Figgis, wrote an early authoritative volume, *Introduction to Ligand Fields*, published in 1966, that rapidly became a classic, and he has subsequently charted progress in the area in review articles. This new volume, each chapter of which contains several references to other books, review articles or key papers, shows the reader just how far the subject has now progressed.

A short introduction to ligand field theory has routinely been provided in most general inorganic chemistry texts for undergraduates for many years now, and some familiarity with the principles of the subject is expected of most graduates in chemistry. Greater familiarity with the subject is, however, required of those interested in the structural, thermochemical, magnetic or electronic and associated spectroscopic properties of transition-metal compounds, whether extended lattice systems or molecular complexes, and this looks likely to become one of the key source books to which such researchers can refer. It is not intended as an introduction to the subject for the typical undergraduate —it assumes too much prior knowledge of molecular orbital theory, symmetry and group theory to provide an easy introduction to its subject matter, though readers already familiar with the relevant symbols and equations should have little difficulty following the arguments or finding the material they seek, and teachers will find the book a real boon.

The first few introductory chapters helpfully set the scene, outlining the quantitative basis of crystal fields, and explaining the angular overlap model (AOM), the molecular orbital approach whereby an examination of ligand and metal orbital interactions allows one to appreciate how the ligand coordination sphere influences the valence shell energy levels. There follow chapters explaining the origin and calculation of ligand field splitting energies Δ, the energy levels of transition-metal ions, and the effects of ligand fields thereon. Later, substantial chapters discuss the influence of the *d* electronic configuration on the geometry and stability of complexes, the electronic spectra of complexes, and the magnetic properties of complex ions. The final two chapters discuss the EPR (electron paramagnetic resonance) spectra of complexes, and the extent to which ligand field effects are of concern in the chemistry of the lanthanide and actinide elements. Series of appendices give useful mathematical relationships, very helpfully list the many symbols used, and provide relevant fundamental constants.

As an interested outsider to the field, I appreciated greatly the short sections scattered throughout the book that put things in perspective, telling the reader what is important and what is not. Examples include the relative importance of ligand field and other effects for different metal types (p. 5), the summary of the key features of AOM on pp. 56 and 57, comparisons with crystal-field (simple electrostatic) arguments on pp. 78–80, the discussion of the distinction between electronic configurations and term states on pp. 93–94, the orbital correlation and Tanabe–Sugano diagrams on pp. 126–141, and the discussion of superexchange pathways starting on p. 273. I could cite many more such sections that concisely convey much information and insight.

Concentrating understandably on systems in which metal ions with incompletely filled *d* shells are surrounded by arrays of ligand atoms acting mainly as σ-donors, possibly also as π-donors or -acceptors, this book may prove of limited interest to organometallic chemist readers of this journal whose main concern is with closed-shell (18-electron) systems containing polyhapto unsaturated organic ligands. Such readers will find little if any reference here to metal-cyclopentadienyls or related systems. Nevertheless, this is an excellent book that deals clearly and rigorously with its chosen subject. It looks destined to be resorted to by those interested in the structures, stabilities and magnetic, electronic and spectroscopic properties of a wide variety of transition-metal complexes. The authors are to be congratulated on packing so much useful information into this one source.

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Method performance studies for speciation analysis

P. Quevauviller

Royal Society of Chemistry, Cambridge, 1998
xxii + 272 pages. £59.50
ISBN 0-85404-467-1

This book follows from the very rapid growth in our ability to detect and measure not only the total element concentration in a matrix (water, soil, biota etc.) but also the different forms in which the element is present (speciation). Speciation drastically affects the toxicity of elements, e.g. arsenic trioxide is very toxic (and the inspiration of innumerable detective stories), whereas arsenobetaine $[(CH_3)_3As^+CH_2COO^-]$ has little or no toxicity. Allied with this comes the knowledge that there are at least 10 forms of organotin present in the natural environment (deriving from tributyltin, for example) — most with different toxicities There are also about 20 naturally occurring methylarsenic species in the marine environment (including a series of dimethylarsenic ribosides) which have a whole range of toxicities and other properties.

Hence there is a need to measure each of the species present and not simply the total element concentration. In addition to this need, researchers have acquired a wide variety of analytical methods to separate and detect the range of species occurring together of a single element (e.g. mercury(II) and methylmercury). How can we be assured that all of these methods, applied to a single sample containing several chemical species, will give (a) the same answer, and (b) the correct answer? Even defining the latter is no simple matter.

In order to encourage confidence and reliability in this area of work, numerous networks and trialling systems have been established in recent years, and those organized by the Standards, Measurement and Testing Programme of the European Union (EU) stand out. Numerous collaborative interlaboratory analytical trials have been held where the methodology is usually to analyse for unknown (to the analysts) concentrations of known species in a sample distributed to each laboratory. The key feature is then a follow-up meeting where results and information are openly exchanged (the results, of course, may have been obtained by different methods).

Out of this may result the availability of a material whose chemical composition, at least as far as a given element and its compounds are concerned, is known. When sufficient confidence exists it may then be defined as a Certified Reference Material (CRM). The usefulness of such CRMs to working scientists in the analytical, regulatory or environmental fields hardly needs to be stated. A number of organometallic compounds have been assessed in this context. The present work summarizes interlaboratory and CRM work for a number of elements of environmental relevance. Four chapters cover the general aims, principles and methodologies of