

undoubtedly a useful source book, if not so complete as its title would suggest, and has a place in all comprehensive chemistry libraries.

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Comprehensive Coordination Chemistry, Volume 2, Ligands; xvii + 1179 pages, ISBN 0-08-035945-0

It is inevitable that comparisons will be made between this series of volumes and the companion "Comprehensive Organometallic Chemistry". Whereas the latter was undoubtedly the outstanding secondary source of information for topics within its scope, the same cannot, I believe, be said for the present volume. The editors have gathered together an impressive group of contributors who are acknowledged experts in their fields; many of them have written reviews on the same topics, although, it must be said, usually at greater length and depth. It is perhaps inevitable that coverage for coordination chemistry would have to be less detailed than that for organometallic chemistry, but in some cases there is even a lack of references to important reviews. More surprising is the fact that individual topics are, in most cases, covered more thoroughly elsewhere.

This volume is organised according to the nature of the ligating atoms, starting with mercury and going on to C, Si, Ge, Sn, Pb, N, O, S, Se, Te, Hal, and H; the concluding chapter deals with P, As, Sb, and Bi, and interposed between this and the H section are a number of chapters dealing with hybrid ligands (referred to as "mixed donor atom ligands"). The Preface to the series indicates that the chapter dealing with phosphorus ligands was not available and would appear elsewhere, and the same information is supplied on the flyleaf. However, it must surely have been the case that the chapter dealing with P, As, Sb, and Bi arrived at a very late stage of production and hence appears as the final chapter. Chapter titles, with authors, are as follows: 11, "Mercury as a Ligand", by P.A.W. Dean (4 pages, 45 refs.); 12.1, "Cyanides and Fulminates", by A.G. Sharpe (7 pages, 47 refs.); 12.2, "Silicon, Germanium, Tin, and Lead", by P.G. Harrison and T. Kikabai (6 pages, 43 refs.); 13.1, "Ammonia and Amines", by D.A. House (36 pages, 898 refs.); 13.2, "Heterocyclic Nitrogen-donor Ligands", by R. Reedijk (22 pages, 174 refs.); 13.3, "Miscellaneous Nitrogen-containing Ligands", by B.F.G. Johnson, B.L. Haymore, and J.R. Dilworth (51 pages, 510 refs.); 13.4, "Amido and Imido Metal Complexes" by M.H. Chisholm and P.I. Rothwell (22 pages, 254 refs.); 13.5, "Sulfurdiimine, Triazenido, Azabutadiene, and Triatomic Hetero Anion Ligands", by K. Vrieze and G. van Koten (48 pages, 355 refs.); 13.6, "Polypyrazolylborates and Related Ligands", by A. Shaver (12 pages, 69 refs.); 13.7, "Nitriles", by H. Endres (6 pages, 39 refs.); 13.8, "Oximes, Guanidines, and Related Species", by R.C. Mehrotra (18 pages, 261 refs.); 15.1, "Water, Hydroxide, and Oxide", by J. Burgess (15 pages, 228 refs.); 15.2, "Dioxygen, Superoxide, and Peroxide", by H.A.O. Hill (15 pages, 187 refs.); 15.3, "Alkoxides and Aryloxides", by M.H. Chisholm and I.P. Rothwell (23 pages, 303 refs.); 15.4, "Diketones and Related Ligands", by A.R. Siedle (37 pages, 639 refs.); 15.5, "Oxyanions", by B.J. Hathaway (19 pages, 133 refs.); 15.6, "Carboxy-

lates, Squarates, and Related Species”, by C. Oldham (20 pages, 177 refs.); 15.7, “Hydroxy Acids”, by J.D. Pedrosa de Jesus (21 pages, 196 refs.); 15.8, “Sulfoxides, Amides, Amine Oxides, and Related Ligands”, by P.L. Goggin (14 pages, 135 refs.); 15.9, “Hydroxamates, Cupferron, and Related Ligands”, by R.C. Mehrotra (7 pages, 123 refs.); 16.1, “Sulfides”, by A. Müller and E. Diemann (31 pages, 170 refs.); 16.2 “Thioethers”, by A. Müller and E. Dieman (5 pages, 52 refs.); 16.3, “Metallothio Anions”, by A. Müller and E. Dieman (16 pages, 39 refs.); 16.4, “Dithiocarbamates and Related Ligands”, by J.A. Cras and J. Willemse (12 pages, 141 refs.); 16.5, “Dithiolenes and Related Species”, by U.T. Mueller-Westerhoff and B. Vance (31 pages, 223 refs.); 16.6, “Other Sulfur-containing Ligands”, by S.E. Livingstone (21 pages, 259 refs.); 17, “Selenium and Tellurium Ligands”, by F.J. Berry (10 pages, 133 refs.); 18, “Halogen as Ligands”, by A.J. Edwards (11 pages, 118 refs.); 19, “Hydrogen and Hydrides as Ligands”, by R.H. Crabtree (21 pages, 175 refs.); 20.1, “Schiff Bases as Acyclic Polydentate Ligands”, by M. Calligaris and L. Randaccio (19 pages, 146 refs.); 20.2, “Amino Acids, Peptides, and Proteins”, by S.H. Laurie (34 pages, 138 refs.); 20.3, “Complexones”, by G. Anderegg (13 pages, 17 refs.); 20.4, “Bidentate Ligands”, by R.S. Vagg (15 pages, 254 refs.); 21.1, “Porphyrins, Hydroporphyrins, Azaporphyrins, Phthalocyanines, Corroles, Corrins, and Related Macrocycles”, by T. Mashiko and D. Dolphin (78 pages, 278 refs.); 21.2, “Other Polyaza Macrocycles”, by N.F. Curtis (13 pages, 54 refs.); 21.3, “Multidentate Macrocyclic and Macropolycyclic Ligands”, by K.B. Mertes (37 pages, 276 refs.); 22, “Naturally Occurring Ligands”, by S.H. Laurie (26 pages, 172 refs.); 23, “Phosphorus, Arsenic, Antimony, and Bismuth Ligands”, by C.A. McAuliffe (71 pages, 329 refs.). The volume concludes with a substantial Subject Index (34 pages) and a Formula Index (74 pages).

It would be impracticable to deal with each chapter, and therefore what follows is selective. Chapter 12.1 deals with transition metal complexes having $\overline{\text{CN}}$ or $\overline{\text{CNO}}$ as ligand. Inevitably, the coverage is much more cursory than in Dr. Sharpe's 1976 book dealing with the first of these topics, or in various reviews. Among the relatively small number of references the cut-off point is 1983 (4 papers bear that date).

Chapter 12.2 deals with the heavier of Group 14 element-centred ligands. The coverage is very much more selective than that by Mackay and Nicholson in “Comprehensive Organometallic Chemistry” (which is not referenced). Recent relevant reviews include one in Chem. Rev. by Petz, which also does not receive a mention, perhaps because the cut-off date for references is 1984 (4 papers bear that date).

Chapter 13.1 may well be one of the most useful chapters, not least because of the vast number of references. There are two citations for 1985, but none for 1984. Coverage includes numerous multidentate ligands.

Chapter 13.3 treats complexes having the following ligands: $\overline{\text{NO}}$, $\overline{\text{NS}}$, $\overline{\text{N}}=\overline{\text{PR}}_3$, $\overline{\text{N}}=\overline{\text{CR}}_2$, $\overline{\text{N}}=\overline{\text{NR}}$, ${}^2\overline{\text{N}}\overline{\text{NH}}_2$, and $\overline{\text{N}}\overline{\text{H}}\overline{\text{NH}}_2$. The coverage is more up to date than in almost any other chapter, there being several references to the 1984 literature.

Chapter 13.4 deals with metal amides and imides, and this is one of the few chapters where there is some sort of balance between transition metal and main group elements. (Elsewhere in the book the emphasis is strongly towards the *d*-block elements.) While the treatment is as reasonable as can be expected in a chapter of 23 pages, once again we have a major topic which has been covered much more

extensively elsewhere; for example, the reviewer was the co-author of a book in which metal and metalloid amides were covered in about 800 pages of text, and the topic of metal imides was dealt with in far greater detail by Nugent and Haymore. Reference to these reviews and others is given. It should be stressed that these comments are not intended as a criticism of the authors, who presumably were not allocated more space. On the matter of balance, one might dispute whether it is appropriate to have 51 pages devoted to the topic of Chapter 13.3, but only 22 for Chapter 13.4.

Chapter 13.4 deals with complexes having the ligands: $\text{RN}=\text{S}=\text{NR}$, $\text{RN}=\text{S}=\text{O}$, $[\text{RN}_3\text{R}]^-$, $[\text{RNC}(\text{R}')\text{NR}]^-$, $\text{RN}=\text{C}(\text{R}')\text{C}(\text{R}'')=\text{NR}$, $\text{RN}=\text{NN}=\text{NR}$, and the triatomic pseudohalides N_3^- , $[\text{NCO}]^-$, $[\text{NCS}]^-$, $[\text{NCSe}]^-$, and $[\text{NCTe}]^-$. The coverage is restricted to the transition elements, which in the context of the pseudohalides is particularly curious, as the topic of main group element analogues represents a substantial area.

Chapter 15.3 is concerned with compounds having $\bar{\text{O}}\text{R}$ or $\bar{\text{O}}\text{Ar}$ as ligands. Unlike the same authors' contribution on the metal amides (Chapter 13.4), there is only cursory mention of main group compounds; it seems somewhat arbitrary that whereas the bulky group 14 metal(II) amides are covered, similar mention is not made of the corresponding aryloxides. This chapter does not seem to be as good as that on amides/imides by the same authors. There are a few clerical errors among the references.

Chapter 15.4 is oddly named. Diketones, of course, are rarely ligands and in fact that topic quite appropriately is dealt with in about one page. I suppose a point might be stretched so as to include β -diketonates as ligands related to β -diketone ligands.

Chapter 18 similarly bears a somewhat odd title. Surely, the ligands are "halides" rather than "halogens". As in so many other chapters, main group elements receive rather little attention. The opening sentence may give some idea of the level at which the coverage is aimed: "Although there are authoritative and extensive reviews of the chemistry of the halogens available, these usually cover the complete chemistry of the elements, and are not restricted to coordination chemistry [1-4]". Readers might like to note that ref. 4 is to the textbooks by Cotton and Wilkinson, Purcell and Kotz, and Greenwood and Earnshaw.

The final chapter deals with ligands having a pnictogen as ligating atom. This, of course, is a vast field, and among more substantial surveys are books by the author of the chapter. However, although many reviews on individual groups of these ligands abound, this is a useful contribution and the coverage of the literature is among the most up to date.

Inevitably, there are ligands which might have deserved a place, among which I would include $[\text{BF}_4]^-$ and $[\text{BH}_4]^-$.

The production of the volume is exemplary and of the same high standard as that for the companion volume "Comprehensive Organometallic Chemistry". No doubt there are many favourable features to be found here, but there is no individual topic which, I believe, is not better covered elsewhere.