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Book Review

Inorganic Reactions and Methods. Volume 1: The Formation of Bonds to Hydrogen (Part 1), edited by J.J. Zuckerman, VCH Publishers, Weinheim (Germany), 1986, xxv + 326 pages, DM 275. ISBN 3-527-26259-8.

The 1980's has undoubtedly been the decade in which inorganic chemists have been treated most royally by the major publishing companies. The Gmelin Handboook of Inorganic Chemistry appeared in English for the first time in its history, *Comprehensive Organometallic Chemistry* was published a few years ago, and *Comprehensive Coordination Chemistry* is promised for later this year. All of these major works share one thing in common, apart from excellence in style, content, presentation and editing - they are all organized upon the basis of elements and compound types. This is, and always has been (back to the days (1877) of the seminal volumes, *A Treatise on Chemistry*, by Roscoe and Schorlemmer, and Sidgwick's classic work, the *Chemical Elements and their Compounds*, published in 1950) the traditional and accepted method of describing inorganic compounds and, implicitly, inorganic chemistry. Jerry Zuckerman has now broken this mould with the appearance of the first two (of the first eighteen) volumes of *Inorganic Reactions and Methods*. Here, I believe for the first time, it is bond formation and type of reaction that forms the basis of the classification, *i.e.* the series is based on chemistry rather than chemicals. This, to my mind, is one of the most exciting developments in treating inorganic chemistry as an overall subject that I have ever encountered, and the global plan for the series is reproduced in the Figure. The pattern and overall philosophy of the series is clear from this, and the reaction types which do not fall facilely into the scheme of simple bond formation (*e.g.* oxidative addition, reductive elimination, insertions and eliminations, electron-transfer and electrochemical reactions, photochemical reactions and pulse radiolysis, catalysis, oligomerization, polymerization, and the formation of intercalation compounds and ceramics) are treated as special topics in the last five volumes. The planning, structuring and editing of such a series is a gargantuan task, and we will be eternally in Jerry Zuckerman's debt for masterminding (and devoting so much time to) this splendid series. The approach to the presentation, citations, and even the English language, can best be described as economical. A prime example comes

Inorganic Reactions and Methods

Volume 1
- **1. Formation of Bonds to Hydrogen**
- 1.1. Introduction
- 1.2. Formation of Hydrogen
- 1.3. Formation of Hydrogen–Halogen Bonds
- 1.4. Formation of Bonds between Hydrogen and O, S, Se, Te, Po

Volume 2
- 1.5. ——N, P, As, Sb, Bi
- 1.6. ——C, Si, Ge, Sn, Pb
- 1.7. ——B, Al, Ga, In, Tl
- 1.8. ——Li, Na, K, Rb, Cs, Fr or Be, Mg, Ca, Sr, Ba, Ra
- 1.9. ——Cu, Ag, Au or Zn, Cd, Hg
- 1.10. ——Transition and Inner-Transition Metals
- 1.11. ——Group 0 Gases
- 1.12. Reversible Formation of Metal Hydrides by Direct Reaction of Hydrogen

Volume 3
- **2.1. Formation of Bonds to Halogens**
- 2.1. Introduction
- 2.2. Formation of Halogen–Halogen Bonds
- 2.3. Formation of Bonds between Halogens and O, S, Se, Te, Po
- 2.4. ——N, P, As, Sb, Bi
- 2.5. ——C, Si, Ge, Sn, Pb
- 2.6. ——B, Al, Ga, In, Tl
- 2.7. ——Li, Na, K, Rb, Cs, Fr or Be, Mg, Ca, Sr, Ba, Ra
- 2.8. ——Cu, Ag, Au or Zn, Cd, Hg

Volume 4
- 2.9. ——Transition and Inner-Transition Metals
- 2.10. ——Group 0 Gases
- 2.11. Formation of Fluorides of High Oxidation State of Elements of Groups IB, IIB and Transition and Inner-Transition Metals

Volume 5
- **3. Formation of Bonds to O, S, Se, Te, Po**
- 3.1. Introduction
- 3.2. Formation of Bonds between O, S, Se, Te, Po and O, S, Se, Te, Po
- 3.3. ——N, P, As, Sb, Bi
- 3.4. ——C, Si, Ge, Sn, Pb
- 3.5. ——B, Al, Ga, In, Tl
- 3.6. ——Li, Na, K, Rb, Cs, Fr or Be, Mg, Ca, Sr, Ba, Ra

Volume 6
- 3.7. ——Cu, Ag, Au or Zn, Cd, Hg
- 3.8. ——Transition and Inner-Transition Metals
- 3.9. ——Group 0 Gases
- 3.10. Formation of Nonstoichiometric Oxides
- 3.11. Formation of Nonstoichiometric Sulfides, Selenides and Tellurides

Volume 7
- **4. Formation of Bonds to N, P, As, Sb, Bi**
- 4.1. Introduction
- 4.2. Homoatomic Bonds
- 4.3. Heteroatomic Bonds
- 4.4. Formation of Bonds between N, P, As, Sb, Bi and C, Si, Ge, Sn, Pb
- 4.5. ——B, Al, Ga, In, Tl
- 4.6. ——Li, Na, K, Rb, Cs, Fr or Be, Mg, Ca, Sr, Ba, Ra

Volume 8
- 4.7. ——Cu, Ag, Au or Zn, Cd, Hg
- 4.8. ——Transition and Inner-Transition Metals
- 4.9. ——Group 0 Gases
- 4.10. Compounds and Alloys of B, Al, Ga, In, Tl and N, P, As, Sb, Bi

Volume 9
- **5. Formation of Bonds to C, Si, Ge, Sn, Pb**
- 5.1. Introduction
- 5.2. Formation of Bonds between C, Si, Ge, Sn, Pb and C, Si, Ge, Sn, Pb

Volume 10
- 5.3. ——B, Al, Ga, In, Tl
- 5.4. ——Be, Mg, Ca, Sr, Ba, Ra

Volume 11
- 5.5. ——Li, Na, K, Rb, Cs, Fr
- 5.6. ——Cu, Ag, Au
- 5.7. ——Zn, Cd, Hg

Volume 12
- 5.8. ——Transition and Inner-Transition Metals
- 5.9. ——Group 0 Gases
- 5.10. Formation of Carbides, Silicides and Germanides

Volume 13
- **6. Formation of Bonds to B, Al, Ga, In, Tl**
- 6.1. Introduction
- 6.2. Formation of Bonds between B, Al, Ga, In, Tl and B, Al, Ga, In, Tl
- 6.3. ——Li, Na, K, Rb, Cs, Fr or Be, Mg, Ca, Sr, Ba, Ra
- 6.4. ——Cu, Ag, Au or Zn, Cd, Hg
- 6.5. ——Transition and Inner-Transition Metals
- 6.6. ——Group 0 Gases
- 6.7. Formation of Borides

Volume 13
- **7. Formation of Bonds to Li, Na, K, Rb, Cs, Fr or Be, Mg, Ca, Sr, Ba, Ra**
- 7.1. Introduction
- 7.2. Formation of Bonds between Li, Na, K, Rb, Cs, Fr or Be, Mg, Ca, Sr, Ba, Ra and Li, Na, K, Rb, Cs, Fr or Be, Mg, Ca, Sr, Ba, Ra
- 7.3. ——Cu, Ag, Au or Zn, Cd, Hg
- 7.4. ——Transition and Inner-Transition Metals
- 7.5. ——Group 0 Gases

Volume 13
- **8. Formation of Bonds to Cu, Ag, Au or Zn, Cd, Hg**
- 8.1. Introduction
- 8.2. Formation of Bonds between Cu, Ag, Au or Zn, Cd, Hg and Cu, Ag, Au or Zn, Cd, Hg
- 8.3. ——Transition and Inner-Transition Metals
- 8.4. ——Group 0 Gases

Volume 14
- **9. Formation of Bonds to Transition and Inner-Transition Metals**
- 9.1. Introduction
- 9.2. Formation of Bonds between Transition and Inner-Transition Metals and Transition and Inner-Transition Metals
- 9.3. ——Group 0 Gases

Volume 14
- **10. Oxidative-Addition and Reductive-Elimination Reactions**
- 10.1. Introduction
- 10.2. Oxidative Additions and Reductive Eliminations for Compounds of the Typical Elements
- 10.3. ——Compounds of the Transition Elements

Volume 14
- **11. Insertion Reactions and Their Reverse**
- 11.1. Introduction
- 11.2. Insertions into Bonds between Elements and Hydrogen
- 11.3. ——Carbon
- 11.4. ——Nitrogen and the Heavier Elements of Group VB
- 11.5. ——Oxygen and the Heavier Elements of Group VIB
- 11.6. ——Halogens
- 11.7. Insertions into Metal–Metal Bonds
- 11.8. Miscellaneous Insertions and Related Reactions

Volume 15
- **12. Electron-Transfer and Electrochemical Reactions**
- 12.1. Introduction
- 12.2. Electron Transfer
- 12.3. Electrochemical Reactions

Volume 15
- **13. Photochemical and Other Energized Reactions**
- 13.1. Introduction
- 13.2 Photosubstitution and Photoisomerization
- 13.3 Photoinduced Cleavage of Metal–Metal Bonds
- 13.4. Photoinduced Electron-Transfer Reactions
- 13.5. Pulse Radiolysis

Volume 16
- **14. Reactions Catalyzed by Inorganic Compounds**
- 14.1. Introduction: Principles of Catalysis
- 14.2. Types of Catalysts
- 14.3. Hydrogenation Reactions
- 14.4. Addition Reactions
- 14.5. Olefin Transformations
- 14.6. Carbon Monoxide Reactions
- 14.7. Oxidations
- 14.8. Bioinorganic Catalysis

Volume 17
- **15. Oligomerization and Polymerization**
- 15.1. Introduction
- 15.2. Ring–Ring and Ring–Polymer Interconversions

Volume 17
- **16. Formation of Intercalation Compounds**
- 16.1. Introduction
- 16.2. Formation of Clathrates
- 16.3. Formation of Tunnel Structures
- 16.4. Formation of Sheet Structures

Volume 18
- **17. Formation of Ceramics**
- 17.1. Introduction
- 17.2. Preparative Methods
- 17.3. Synthesis and Fabrication of Ceramics for Special Applications

FIGURE: The overall plan for *Inorganic Reactions and Methods*

from the hierarchy of sub-headings, which form sentences in their own right. For example:

1.2. The Formation of Hydrogen

1.2.7. by Reactions of Water

1.2.7.5. involving Water Splitting

1.2.7.5.1. in Electrochemical Reactions.

Names, personalities, superfluous qualifications, adjectives, adverbs and compound names (formulæ being used instead) have been ruthlessly excised in a manner to bring joy to the hearts of readers of Borges. The writing style is thus terse, cuttingly to the point, and instantly informative. Historical precedence for reactions and citations has been sacrificed on the altar of synthetic utility, high yield, convenience, and specificity. The result is a remarkably useful text - books for using, not for collecting dust. This revolutionary presentation is complemented by the most thorough indexing (in this, *Comprehensive Organometallic Chemistry* has clearly been emulated and, astoundingly, improved upon by the subject index editor - A.P. Hagen). In Volume 1, of the 326 pages of text, 90 pages are index pages. There is an author index, a compound index (based on empirical formulæ appearing in all possible successive permutations to allow ease of reference to related compounds), and a subject index. These indices crown the accomplishment of the text. Access to the information is the key to success for these volumes, and the indices are superlative.

The above paragraphs more than adequately describe the philosophy behind this series. Now attention must be turned to the specific contents of Volume 1, the subject of this review. Inevitably, given the structure of the series, the opening volume deals with the formation of bonds to hydrogen, and the first real section describes the formation of dihydrogen itself (74 pages). The next section (25 pages) deals with the formation of hydrogen-halogen bonds, and the final section (128 pages) describes the formation of bonds between hydrogen and the elements of Group 16 (referred to here, archaically, as Group VIB). An odd, almost perverse, omission in this volume and series, organized as they are around the importance of the chemical bond and bond formation, is the subject of hydrogen bonding - it does not even appear in the subject index. This aside, though, the volume is an invaluable source of information about the hydrides of Groups 16 and 17. Once we get used to the format, and learn how to use these volumes automatically, I

believe that they will become the primary source for determining synthetic strategy.

No chemistry library can afford to be without these volumes, and would be well advised to take out a subscription, and avail themselves of the lower prices (DM 223 for this volume). The production of these type-set volumes is first class, but they are expensive, and the price will surely preclude them from private bookshelves. This is unfortunate but, given the amount of effort and team-work that it takes to produce volumes of this calibre, probably inevitable.

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