

BOOK REVIEW

Gmelins Handbuch der Anorganischen Chemie. (Ergänzungswerk zur 8. Auflage.) *Band 2, Vanadium-organische Verbindungen. Band 3. Chrom-organische Verbindungen*; Ed. by A. Slawisch, M. Becke-Goehring and K.-C. Buschbeck, (Gmelin Institut für anorganische Chemie und Grenzgebiete in der Max-Planck-Gesellschaft), Verlag Chemie GmbH, Weinheim/Bergstrasse, 1971; 522 pages, DM 622.

The Gmelin Handbuch der anorganischen Chemie series has long been an invaluable aid to the chemist. Its encyclopedic coverage of the chemical and physical properties of the elements and of their inorganic compounds has put the world's inorganic chemistry at the chemist's fingertips.

In 1958 the Gmelin Institute published a volume on the organometallic chemistry of silicon. At that time it was the hope of all organometallic chemists that this would be the first of a series of Gmelin volumes dealing with the organometallic chemistry of *all* the metals and metalloids. Unfortunately, such was not the case, and we have had to wait thirteen years for the beginning of the realization of this hope.

The book presently under discussion treats, in two volumes (between two covers), the organic compounds of vanadium (70 pages) and chromium (452 pages), and it is the first of an intended series of Gmelin volumes devoted to organometallic chemistry—a series which will receive a warm welcome from all chemists active in the wide field of organometallic chemistry. The coverage of the areas discussed is in the usual exhaustive and definitive fashion. In the case of vanadium, it is complete to the end of 1970; in the case of chromium, some January 1971 references are included. Whatever has been published about a compound is reported: a wide variety of physical and spectroscopic properties, structural information, often with figures, methods of preparation, chemical properties and chemical transformations, applications and catalytic properties. No stand is taken on controversial questions (*i.e.*, the symmetry of dibenzenechromium), but all the data and the pertinent references are supplied. References abound and are to be found at the end of each sub-section. They include references to journal articles in every conceivable language, conference reports, theses and patents. Very welcome also are the many general references to reviews and books given at appropriate places. One has the comfortable feeling that if it's been done and published in any way, it will be found in this book.

The organization of these volumes does not follow the usual Gmelin plan. Instead, the following divisions are used. The first subdivision is made according to the number of principal metal atoms in the molecule (vanadium and chromium, in the present instances): mononuclear, dinuclear, trinuclear, etc., irrespective of whether the metal atoms are bonded to one another or are in remote parts of the molecule. Further subdivision takes into consideration the number of metal-bonded carbon atoms of the organic ligand and follows, more or less, Cotton's "hapto" classification, although this designation is not used. Thus the discussions proceed according to the following order (in the case of chromium): *Monohapto* (alkyls, aryls, acetylides; $\text{Cr}(\text{CO})_6$ and its substitution products involving non-carbon donors;

carbene complexes); *dihapto* (olefin complexes, and curiously, by the rules in which only carbon atoms count, the dicarbollide complexes, which really have *pentahapto* ligands); *trihapto* (π -allyl complexes); *tetrahapto* (π -thiophene and π -selenophene complexes, where only four carbon atoms are involved, diene complexes, including π -cyclobutadiene compounds); *pentahapto* (mainly π -cyclopentadienyl, but also π -pyridinium types); *hexahapto* (π -arene complexes and *hexahapto* complexes involving rings with more than six carbon atoms). The organizational system in these volumes is well conceived and clearly explained, and it does not take long to become familiar with it.

This book, of course, is written in German, but English subheadings abound and will be very helpful to the reader whose knowledge of German is lacking. Also, it is important to note that the Table of Contents and the preface in which the organization is explained are given in English as well as in German.

At the end of each volume is found a Ligand Formula Register in which all compounds in these volumes are listed according to the types (but not number) of ligands present. Unfortunately, the ligands are listed in terms of their empirical formulae, which, of course, provides no structural information at all. With simple, familiar ligands this is adequate—one soon gets used to seeing $(C_6H_5)_3P$ as $C_{18}H_{15}P$ —but in the case of complicated ligands this leads to mystification. One must return to the page cited to find out that $C_{30}H_{33}NP_2$ is $[(C_6H_5)_2PC_2H_4]_2NC_2H_5$. Thus this register is useful if one has a specific ligand or compound in mind, but it cannot be used for browsing to see what kind of ligand systems are possible. This, however, is only a minor criticism.

These volumes are a most excellent contribution to the literature of organometallic chemistry. To the chemists doing research in the organovanadium and organochromium areas they will be indispensable aids. Unfortunately, the price of this book is beyond the reach of most organometallic chemists, and so it will mostly be found on the shelves of libraries and less usually at the desk of the individual chemist. It deserves far wider circulation than that!

Dietmar Seyferth