

# Book Reviews

**Analysis of Silicones.** Edited by A. Lee Smith. Robert E. Krieger Publishing Co., Malabar, Florida. 1983. viii + 407 pp. \$49.50.

This book is a reprint of Volume 41 of the "Chemical Analysis" monograph series edited by Elving and Kolthoff which was published by Wiley in 1974. The reprinting of out-of-print books, when these are chosen carefully, can be a useful endeavor. The publishers have chosen well in the present case since research in organosilicon monomer and polymer chemistry continues at a brisk pace. One wishes, however, that the editor had chosen instead to bring out a second, up-dated edition: there has been much progress since 1974 in instrumental (especially spectroscopic) methods which are applicable to the analysis of organosilicon systems.  $^{29}\text{Si}$  FT-NMR spectroscopy and solid-state NMR spectroscopy have come into their own since 1974. The applicability of mass spectrometry has become much greater with the advent of many new techniques, and other new analytical and spectroscopic techniques are available as well.

Nonetheless, this is a useful book. In the absence of a more modern version, it is nice to have this summary of the analysis of silicones as of 1973 available again. The authors are all members of the Dow Corning Corp. research staff, so it is certain that they write with authority based on abundant experience.

This is a "how to" book. It is short on theory but long on practical advice. As such it will be useful to many workers in the organosilicon area.

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**Gmelin Handbook of Inorganic Chemistry. 8th Edition. B. Boron Compounds.** 2nd Supplementary Volume 1. Boron and Noble Gases, Hydrogen, Oxygen, Nitrogen. L. Barton, K. Beeker, G. Heller, and A. Meller, volume authors. K. Niedenzu, volume editor. 2nd Supplementary Volume 2. Boron and Halogens, Chalcogens, Carboranes. K. Beeker, A. Meller and T. Onak, volume authors. K. Niedenzu, volume editor. Gmelin Institut für Anorganische Chemie der Max-Planck-Gesellschaft zur Förderung der Wissenschaften and Springer-Verlag, Berlin/Heidelberg/New York. Volume 1: 1983. xvi + 508 pages. DM 1566, \$646.80. Volume 2: 1982. vii + 376 pages. DM 1185, \$474.00.

With these two books the literature coverage of boron compounds in the Gmelin boron series is uniformly brought up to 1980. Thus this element and its compounds are the subject of two older "main" volumes, 20 recent New Supplement Series volumes, and five supplementary volumes. This complete boron literature coverage through 1980 is a tremendous achievement. Anyone doing research in any aspect of boron chemistry will find these volumes extremely useful.

The organization of the present two books follows that of the main volume ("Principle of Last Position") except that the section on boron hydrides also contains all polyboranes with B-B bonds and some organic boron compounds are covered as well. Carboranes are treated comprehensively. Thus, the first book begins with what little is known about boron and the noble gases ( $\text{HeB}^+$ ,  $\text{NeB}^+$ ,  $\text{ArB}^+$  calculations;  $\text{Ar-BF}_3$ ) and proceeds on to the boron hydrides ( $\text{BH}$ ,  $\text{BH}_2$ ,  $\text{BH}_3$ ; ionic species such as  $\text{BH}_4^-$ ,  $\text{R}_3\text{BH}^+$ ,  $\text{R}_2\text{BH}_2^-$ ,  $\text{H}_3\text{BCN}^-$ ,  $\text{L}_2\text{BH}_2^-$ ;  $\text{B}_2\text{H}_6$  and its derivatives;  $\text{B}_2\text{H}_4$  derivatives, including the diboron tetrahalides and then the higher boron hydrides, including quite a few transition-metal derivatives). The systems boron-oxygen and boron-nitrogen follow and these include a wealth of compounds.

The second book is devoted to boron halides (including their hydro and organo derivatives), boron compounds of the group 6 elements, and carboranes and metallacarboranes.

Some other boron compounds have been left out (for instance, those with B-Si, B-Ge, and B-Sn bonds, as well as those with

B-P, B-As, and B-Sb bonds) because the "Gmelin Principle of Last Position" is followed. But these are few in number and one may guess that over 90% of all boron compounds have been covered. Outside of this, the usual Gmelin thoroughness is apparent. The literature citations are not only to chemical journals, books, theses, patents, and conference reports but also to all sorts of other journals that deal with other areas of physical science and engineering. The coverage is very broad indeed. The emphasis, as usual, is on the preparation of the individual compounds, their physical and spectroscopic properties, their chemical conversions, and their applications.

Each book has its own formula index. An especially useful facet is the indication of cyclic systems (e.g., BNCNC for  $\text{BrB}(\text{-NCH}_2\text{CH}_2\text{-})_2$ ) since cyclic compounds abound in B-O and B-N chemistry. Both books, as usual, are well produced. There are many figures, which is helpful to the reader, and much of the data are presented in clear tabular form.

Research in all areas of boron chemistry continues at a brisk pace, and in a few years hence a third set of supplementary volumes no doubt will be needed.

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**Catalysis in  $\text{C}_1$  Chemistry.** W. Keim, editor. Volume 4 of Catalysis by Metal Complexes. R. Ugo and B. R. James, Editors. D. Reidel Publishing Co., Dordrecht. 1983. xi + 312 pages. \$58.50.

This volume had its genesis in a three-day  $\text{C}_1$  chemistry course organized at the Technical University of Aachen by Prof. Keim, Dr. A. Behr, and Dr. M. Röper of Aachen, Prof. P. Teyssié and Prof. A. J. Hubert of the University of Liegé, and Prof. R. Ugo of the University of Milan. It is classified as volume 4 in the series: Catalysis by Metal Complexes. The emphasis is on homogeneous catalysis, even though the extremely important and currently active Fischer-Tropsch reaction, for which homogeneous catalysts are very few, constitutes a large portion of the volume. Nine chapters review aspects of the building blocks  $\text{CO}/\text{H}_2$ ,  $\text{CH}_3\text{OH}$ ,  $\text{CO}$ ,  $\text{CO}_2$ ,  $\text{CH}_4$ ,  $\text{HCN}$ , and  $\text{CR}_2$ .

In the first chapter (35 pages, 105 references), Prof. W. Keim reviews *Homogeneous Carbon Monoxide Hydrogenation*. This is a tutorial on modes of CO coordination, CO activation (scission and bond formation), growth products both with and without oxygen retention, and various views of the direct reduction of CO with hydrogen. This serves well to introduce the following chapters, in addition to its own merit.

Chapter 2 (48 pages, 174 references) covers *Fischer-Tropsch Synthesis* and is written by M. Röper. It describes the hydrocarbon synthesis from both a technological and a theoretical perspective. Included are the historical development, a description of SASOL I, practical metals, catalyst preparations, promoters, and poisons. In a second section, more recent investigations directed toward characterization of surface species, mechanistic considerations, and selective olefin formation are described.

Chapter 3 (16 pages, 50 references, by W. Keim) is titled *Methanol: Building Block for Chemicals*. This short chapter outlines a large number of derivatives, both oxygenated and olefinic, which have been synthesized with methanol as raw material. It is followed by *The Homologation of Methanol* by M. Röper and H. Loevenich (30 pages, 90 references), which details one of the more heavily investigated reactions of methanol.

*Hydroformylation and Carbonylation Reactions* (33 pages, 25 references, including 13 review articles) is the topic of Chapter 5, written by R. Ugo. Unmodified cobalt, phosphine-modified cobalt, and phosphine-modified rhodium catalysts are described and compared. An interesting departure from the usual treatment is a unified approach involving four phases, which incorporates Reppe-type chemistry as well as hydroformylation, even though the processes may involve different metals, different ligands, and

different reaction conditions. The closing sections of the chapter include oxidative carbonylations with the formation of acrylates, oxalates and carbonates.

Chapter 6, *Activation of Carbon Dioxide via Coordination to Metal Complexes* (49 pages, 312 references, by A. Behr), addresses the field of CO<sub>2</sub> chemistry, which has received increasing attention in recent years. Most of the references are in the period 1972–1980. This chapter is a comprehensive survey of the subject, organized in an excellent manner. Particularly interesting are the sections on the rich chemistry of CO<sub>2</sub> with alkynes and dienes and on the effects of CO<sub>2</sub> as a cocatalyst.

Chapter 7 is *Hydrocyanation* (26 pages, 56 references, by A. J. Hubert and E. Puentes). Applications of HCN in organic chemistry other than addition to multiple bonds are noted, in addition to the hydrocyanation of butadiene (hexamethylenediamine synthesis) and acetaldehyde or acetone (acrylates syntheses).

*Methane* is treated in Chapter 8 by A. J. Hubert (16 pages, 55 references). The topic is expanded to include higher alkane activation. The biological origin of methane and its metalloenzyme activation are included. Industrial uses are noted although the largest chemical usage—hydrogen for ammonia—is neglected.

In the final chapter, A. J. Hubert discusses *Carbenes* (31 pages, 54 references). This is a timely subject since carbenes, so important in organic syntheses, have emerged as important intermediates in transition-metal-catalyzed reactions such as olefin metathesis and Fischer-Tropsch hydrocarbon synthesis.

The volume is very readable, and the index is quite adequate. In general, the subjects are treated in sufficient depth to give the reader access to the present state of technology and recent mechanistic information. It does contain a noticeable number of typographical errors and incomplete German-to-English translation (e.g., CH<sub>3</sub>J vs. CH<sub>3</sub>I).

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