plex is 132 cm.^{2} mole^{-1} ohm^{-1} in DMF at 25°, in the range expected for a 2:1 electrolyte.

Since all the dianionic bis(mnt) complexes investigated by X-ray diffraction methods have been found to be square planar,[10] we expect a square-planar structure for $Au(mnt)_2^{2-}$. In acetone, the lowest electronic band in $Au(mnt)_2^{2-}$ occurs at 13,750 cm.$^{-1}$ (ϵ 368), as compared with 13,300 cm.$^{-1}$ (ϵ 40) for the $Au(mnt)_2^{-}$ complex, 8300 cm.$^{-1}$ (ϵ 100) for $Cu(mnt)_2^{2-}$, and 6400 cm.$^{-1}$ (ϵ 337) for $Cu(mnt)_2^{-}$. Magnetic susceptibility measurements on samples of $[(n\text{-}C_4H_9)_4N]_2[Au(mnt)_2]$ give $\mu_{eff} = 1.85 \pm 0.05$ B.M., in the range expected for a complex with one unpaired electron and in reasonable agreement with the g value. Considering the magnetic results, it is highly probable that no significant intermolecular interaction between $Au(mnt)_2^{2-}$ groups occurs in $[(n\text{-}C_4H_9)_4N]_2[Au(mnt)_2]$.

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Book Reviews

Organoboron Chemistry. Volume 1. Boron–Oxygen and Boron–Sulfur Compounds. By HOWARD STEINBERG, Vice President and Director of Research, U. S. Borax Research Corp. John Wiley and Sons, Inc., 605 Third Ave., New York, N. Y. 1964. xxxii + 950 pp. 17 × 23.5 cm. $33.00.

"Organoboron Chemistry" is the first of a series of three volumes intended to give complete coverage of this vast field. In the present volume, attention is focused on compounds containing organic groups bonded to boron through boron–oxygen or boron–sulfur bonds. Even with this restriction of scope, the extent of the area is such that the reader will pick up a book purporting to be comprehensive with a feeling of skepticism; he will put it down with a feeling of awe.

The volume is indeed comprehensive and covers all pertinent literature (including patents and unclassified government reports where available) from the early nineteenth century through the end of 1961. Mere collection of this information and logical organization of it is a worthwhile venture that has been successfully completed, but the author has attempted far more and has succeeded in a satisfying way. He has presented his own analysis of the data and explanations of others and also advanced plausible mechanistic interpretations of his own in many instances throughout the book. This extends to a critical examination of mechanisms suggested by others and a substitution of more likely ones where necessary. It is this aspect which will reward the reader with greater insight into the area of his own interest and will also no doubt serve to stimulate much new research. Perhaps the greatest testimony that can be offered to this contribution is the fact that many of Steinberg's novel proposals have already begun to appear in current literature in nearly verbatim form.

Chapters 1, 2, and 3 deal with introductory material and a brief but lucid and useful treatment of nomenclature. Chapter 4 covers in 173 pages the symmetrical orthoborates of monohydric alcohols and phenols. Despite the length of the chapter, the reader will find it simple to find what he seeks, since the Table of Contents is unusually complete and useful.

Chapters 5 through 20 continue the systematic examination of more complex compounds. Chapter 21 treats the related compounds containing sulfur in place of part or all of the oxygen.

The book concludes with a brief but critical chapter on the hydrolytic stability of the boron–oxygen system with emphasis on those quantitative studies that have thus far been carried out. Finally, a series of three appendixes collects useful information on infrared assignments, bond distances and energies, and heat of formation for a few compounds. The active worker in this field will find these most helpful.

Dr. Steinberg has been an active worker in organoboron chemistry for a decade, and the book he has produced reflects this fact. It is the product of a man who knows his field and shows it on every page.

This work will remain the standard work in its field for at least a generation. As such, it will be essential on the shelves of any adequate chemical library. Despite its price (really only four cents per page), it will be less often found in one's personal library unless one actively works in this field.

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Boron, Metallo-Boron Compounds and Boranes. Edited by ROY M. ADAMS, Geneva College, Beaver Falls, Pa. Interscience Publishers, John Wiley and Sons, Inc., 605 Third Ave., New York, N. Y. 1964. xxiii + 765 pp. 16 × 24 cm. $27.50.

"Boron, Metallo-Boron Compounds and Boranes" contains eight chapters on a number of aspects of the chemistry of boron. The eight chapters are essentially eight discontinuous views of relatively unconnected subjects and vary considerably in their quality. Chapter 1 by W. A. Gale is a short review of the borax industry from a historical viewpoint. The chapter is a mine of obscure information (did you know that in ancient times borax was collected in the mountainous desert regions of Tibet and transported to Lahsa to barter for Cowrie shells and other commodities?) which is in fact good entertainment. Chapter 2 by the same author collects considerable equilibria data for aqueous borate systems. Chapter 3 by N. P. Nies and G. W. Campbell treates the over-all field of inorganic boron–oxygen compounds in 143 pages and covers nearly 800 references. In many respects this is the most useful chapter in the book since it collects and organizes a vast body of information. Nearly five pages of the index is devoted to this material and as a result information is readily available. Individual sections contain most of the structural and physical data available for the multitude of compounds known. Chapter 4 by A. E. Newkirk presents a summary of methods for preparing pure elemental boron, a detailed treatment of the complex structural chemistry of the element, and a concise review of the physical and chemical properties of the substance. A similar summary of the refractory binary borides is supplied in Chapter 5 by Professor Post. Useful tables of crystallographic and other data are included together with clear diagrams illustrating the structure of some of the more important forms. Chapter 6 by R. M. Adams and A. R. Siedele treats the rapidly expanding class of ionic boron hydrides. Again a collection of a very large amount of data is presented in the chapter with its nearly 600 references and is useful from this point of view alone. In Chapter 7 Adams has reviewed the chemistry of the boranes and the very extent of the information collected from nearly 800 references is in itself a contribution. The concluding chapter by A. J. Levinskass on toxicology of boron compounds is one of the most welcome in the book. The advances that have been made within the last 15 years have brought boron compounds into a much more common use, and relatively little publicity has been given to the potential hazard owing to toxicity. Any active worker in this field would do well to give the chapter a thorough reading.

In some respects the strengths of the book lead to its deficiencies as well. So much information has been collected that one would

have hoped for a more critical evaluation than has been done in many cases. The lack of evaluation is particularly evident in Chapters 6 and 7 where the 1400 references contain a vast amount of hidden misinformation.

This book will make a useful addition to a library shelf since it will provide a ready entry into published information. Both its price and its nature will make it infrequently found in one's personal library.

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Organic Complexing Reagents: Structure, Behavior, and Application to Inorganic Analysis. By D. D. PERRIN, Department of Medical Chemistry, Institute of Advanced Studies, Australian National University, Canberra. John Wiley and Sons, Inc., 605 Third Ave., New York, N. Y. 1964. xi + 365 pp. 15.5 × 23.5 cm. $12.00.

Here is a volume that lifts itself from mediocrity into a much more exposed position by means of an outrageous preface. Here in Volume XVIII in the well-known Interscience "Chemical Analysis" series, Dr. Perrin attributes to Professors Kolthoff and Elving, the series editors, as well as himself, the awareness that "almost all analytical procedures and books, with the notable exception of F. Feigl's 'Specific, Selective, Sensitive Reactions,' have been concerned with experimental techniques, conditions, or requirements, rather than with information about the basic principles involved in the reactions and with the properties that confer analytical usefulness on the end products." Only two volumes earlier in the same series, the excellent text by Professor A. Ringbom, "Complexation in Analytical Chemistry: A Guide for the Critical Selection of Analytical Methods Based on Complexation Reactions," is an eloquent contradiction to this author's prefatory remarks. Another pertinent text is that of Flagg's, "Organic Reagents Used in Gravimetric and Volumetric Analysis," published as Volume IV of this series. There is a wealth of additional examples of analytical books and shorter publications dealing with fundamental principles of the formation and properties of analytical useful complexes. In addition, most analytical chemists interested in complexing agents know, as does Dr. Perrin, the pertinence of the recent inorganic literature dealing with coordination complexes. There are chapters in Martell and Calvin, and in Bailar, on analytical applications of chelating agents, to name but a few. The chapter in this text dealing with kinetic factors in complex formation contained little that could not be found in Basolo and Pearson's "Mechanisms of Inorganic Chemistry."

This book has very little to offer the serious student of organic complexing agents in the way of novelty, clarity, or thoroughness. Although there are a few scattered recent references, many of them are earlier than 1960. In referring to the use of 8-mercaptoquinoline, a reagent of considerable promise, for example, no reference is made to the important series of papers by Bankovski and his students which have been appearing for the last 5 years, but only to a one-page communication in the *Virginia Journal of Science* appearing in 1943.

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