

Book Reviews

Production of the Boranes and Related Research. Edited by RICHARD T. HOLZMANN, Aerojet-General Corp., Azusa, Calif. Academic Press Inc., 111 Fifth Ave., New York, N. Y. 1967. x + 533 pp. 16 × 23.5 cm. \$22.00.

The search for a superior energy source led to the Manhattan Project, the development of nuclear energy, and the "Smyth Report" which described certain aspects of that program. The present volume represents, in a sense, the "Smyth Report" related to another superior energy source, the high-performance, nonfossil fuels derived from the boron hydrides. This program of research and development at one time or another bore the names "Project Hermes," "Project Zip," and "Project HEF." Regardless of its name and its ultimate fate, this program again illustrates what science can do when faced with a real or imagined problem related to the national defense. In this particular case, a largely unexplored and, in fact, ignored area of chemistry was explored on a very large scale. These studies opened up an entirely new area of chemistry which is only now being digested by the chemical public. For one who was active in the fuel program, the open literature has resembled the top of an iceberg with the greatest body of information submerged in the sea of classification. The present volume presents an accurate description of the research and development which accomplished the synthesis of the boron hydride fuels and, in addition, provided the basis of much of present day research in this area.

The book begins with a series of chapters devoted to the synthesis of the boranes from borate ores and economical reducing agents. Various large-scale procedures are described and identified with the organizations responsible for their process development. The pyrolysis of B_2H_6 to form B_5H_9 and $B_{10}H_{14}$ is described in two separate chapters. These chapters serve to reveal for the first time the very large numbers of possible variations of the pyrolysis procedure which were investigated. The mechanisms of B_2H_6 pyrolysis and isotopic exchange reactions are presented in a separate chapter which points up the current state of knowledge concerning the very complex pyrolysis reactions.

The preparation and properties of alkylated boranes and the methods available for the preparation of synthetic fuels are com-

bined in one chapter. Each of the available methods is clearly described and well documented by previously classified reports.

The discovery of the $B_{10}C_2H_{12}$ icosahedral carboranes and their chemical properties are combined into one chapter. A good deal of this information has not been previously published although carborane chemistry was declassified in 1964. A rather complete compilation of the physical properties of $B_{10}C_2H_{12}$ derivatives is presented in an appendix and should prove useful to workers in the field.

Useful chapters are devoted to the separation and purification of the boranes and analytical methods employed for the estimation of boranes and their derivatives. The analytical methods available to the practicing boron hydride researcher are amply developed.

The acid-base chemistry of the boron hydrides is extensive and important. A chapter devoted to this subject reveals previously unavailable information and many useful references.

The book is endowed with five appendices covering the subjects of toxicology, infrared spectra, molecular structures, and physical properties. The appendix devoted to toxicology is especially interesting since the boranes have attained an undeserved bad reputation as exotic poisons.

The volume contains 1673 early references through 1962. Many of these references are research reports which were previously classified. A supplementary bibliography is also included and contains about 400 additional references to newer work (1963-1966).

Since the authors have not weighed or interpreted the vast amount of data which they report, this book will only be useful as a guide to the previously unavailable literature. Since that was the intended purpose of the volume, it can be said that the original objective was nicely fulfilled and the results of the borane fuel program are now open for public discussion. It is to be hoped that the vast amount of work that went into the preparation of this volume will be repaid by its probable catalytic effect upon research workers not yet attracted to the field of borane and carborane chemistry.

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