

*progestational agent yet described.*⁷ The effect of dehydrogenation at C-1 and C-6 was not cumulative (XI, $A = 35$). Inhibition of ovulation in the rabbit with this series of compounds was found to parallel closely the Clauberg assays.

(7) For the progestational activity of 1- and 6-dehydro-6-methyl-17 α -acetoxyprogesterone derivatives, see ref. 6.

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RECEIVED APRIL 30, 1959

FORMATION OF DIBORANE FROM BORONTRICHLORIDE AND MONOSILANE¹

Sir:

Calculations based on bond energies indicate that the formation of diborane by reaction of silane and trichloroborane should be slightly exothermic. A radical chain process seemed to offer a promising mechanism for achieving hydride transfer. It was subsequently found that mixtures of SiH₄ and BCl₃ do react in the presence of methyl radicals to produce diborane in good yield. Using the photochemical decomposition of azomethane as a source of methyl radicals,² the reaction products were found to be diborane, methane and both mono- and dichlorosilane. In addition, a considerable amount of non-volatile substance was produced in the reaction. In a typical experiment 0.19

(1) Contribution No. 881 from the Department of Chemistry, Indiana University.

(2) The photodecomposition of azomethane occurs readily in Pyrex vessels with radiation of wavelength less than 3660 Å. The quantum yield passes through a maximum in the region 3660 to 3350 Å.; cf. G. S. Forbes, L. J. Heidt and D. V. Sickman, *THIS JOURNAL*, **57**, 1935 (1935).

mmoles of azomethane was decomposed by a 45-minute ultraviolet irradiation in the presence of 4.57 millimoles of SiH₄ and 1.52 millimoles of BCl₃. A 67% yield of diborane (0.51 millimole) was isolated. Reactions thus far have all been carried out at room temperature.

Since methane was among the products and no methyl chloride was observed, it appears that the first step involves the attack of the methyl radical on SiH₄ rather than on BCl₃. It then seems probable that the reaction continues by a radical chain mechanism to the ultimate formation of diborane. The probability of methyl radical attack on SiH₄ was substantiated by noting only partial recovery of silane when mixtures of silane and azomethane were irradiated with ultraviolet light. No attempt has yet been made to identify products of this reaction.

The clear, viscous, non-volatile reaction product was soluble in carbon disulfide and an infrared spectrum showed absorption at 3.9 microns, indicating the presence of boron-hydrogen bonds. Removal of the carbon disulfide left a material soluble in dilute sodium hydroxide, giving a solution which reduced silver nitrate. Prolonged exposure of the original material to air converted it to a water-soluble, white solid.

Experiments are presently being carried out to determine optimum conditions for this reaction. Other radical initiators may be more suitable and will be investigated along with the possibilities of using substituted silanes and other boron halides.

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RILEY SCHAEFFER
LOUIS ROSS

RECEIVED APRIL 23, 1959

BOOK REVIEWS

Low Temperature Physics and Chemistry. Proceedings of the Fifth International Conference on Low Temperature Physics and Chemistry Held at the University of Wisconsin, Madison, Wisconsin, August 26-31, 1957. Edited by JOSEPH R. DILLINGER. The University of Wisconsin Press, 811 State Street, Madison, Wis. 1958. xxv + 676 pp. 16 × 24 cm. Price, \$6.00.

The Madison Conference on Low Temperature Physics and Chemistry was attended by four hundred and forty scientists from fourteen different countries. This book contains the essential content of two hundred and twenty-four papers which were presented. It is impressive evidence not only of the recent growth in quantity of low temperature research but also of the increasing variety of experiments now being carried on in the region near Absolute Zero. Such polar explorations have not only uncovered phenomena such as superconductivity and superfluidity exclusively associated with conditions of low thermal energy; but they are also contributing to many other fields ranging from the thermal, magnetic and electric aspects of the solid state to nuclear behavior; even the possibilities of technical applications of low temperature such as superconducting computer elements are being investigated.

This volume will be valuable to many people in many different ways. First, it gives a quick and yet quite comprehensive bird's eye view of the present state of cryogenic research, a perspective which is enhanced by twenty-six invited papers which are presented at greater length than the contributed papers and form a framework about which the latter papers fall naturally into groups.

In the second place, the papers include a number of important ideas and experiments which are opening up really new vistas; in many cases references are given to places where more complete discussion may be found. Finally there are the reports on work which is the continuation of research already in progress for some years. Naturally, the completeness and quality of the papers vary; but the editing is excellent throughout. The process used for printing makes a readable book, although the illustrations are not as clear as in a normal printed text.

Regarding the topics covered, first there are several dozen papers on the experimental and theoretical aspects of superfluidity and superconductivity. A report by Pellam on a superfluid "wind tunnel" is especially intriguing. Chemists may be glad to see the section on temperature scale and measurement which has a bearing on many thermodynamic

questions. Tisza's papers on lambda transitions and the phase rule should excite interest, even among biochemists. There are many reports on thermal, magnetic and electric properties, but relatively few on spectra at low temperatures. The volume ends with a section on nuclear orientation and parity.

Nicholas Kurti was presented at the conference with the first Fritz London Award for distinguished research at low temperatures; this was especially appropriate in the light of his current pioneering work in opening up the temperature range below 10^{-4} degrees Kelvin. Although his address on this occasion has already been published elsewhere, one regrets that a summary was not included since his work is a real cryogenic milestone.

There is appended at the end of the volume a list of those who attended the conference, a group photograph and a resolution on the conservation of helium gas.

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Proceedings of the Eighth Meeting of the International Committee of Electrochemical Thermodynamics and Kinetics (C.I.T.C.E.). Madrid, 1956. T. P. HOAR, Editor. Butterworth and Co. (Canada) Ltd., ix + 497 pp. 16.5×25 cm. Price, \$19.00.

Review of this volume poses a problem which has now become fairly common. This is not a book in the usual sense of detailed coverage of a fairly narrow, specific area, or of a somewhat shallower but integrated coverage of a broader area. Instead it is as its subtitle says the proceedings of a meeting held in Madrid in 1956. To review the twenty-three more or less original articles which appear in the volume would be equivalent to reviewing an issue of THIS JOURNAL, for instance. The papers are on a variety of topics including experimental methods in electrochemistry, electrochemical kinetics, electrochemical thermodynamics, corrosion and batteries. Some are better than others, some might not have appeared had they been subjected to the usual critical review of original papers. They became available more than two years after they were presented and undoubtedly some of the material has already appeared in journals throughout the world. One unfortunate aspect of the book is the number of intriguing titles in the table of contents which lead only to abstracts, summaries, random thoughts, or very brief notes. An especially disappointing item is the section labeled, "Electrochemistry of Semi-Conductors" which consists of a page and a half note on optical absorption by semi-conductors and their use in photo-elements plus a seven-line written discussion on an entirely different topic.

Many of the papers (8) are concerned largely with what have come to be known best as potential- pH diagrams. This includes one paper on the standard potential for the couple S_6^{--}/S_4^{--} and two in which potential- pH diagrams are used to describe the reactions of iron, zinc, and magnesium under certain conditions. A paper by Okamoto and co-workers on the "rapid" polarization technique, and by Ibl on mass transfer during electrolysis are quite interesting, as is a paper by Hills and co-workers on electrochemical techniques in fused salts up to 1000° . Some of the papers in the section on electrochemical kinetics should be read if their content is not available elsewhere. For example, the paper on the impedance of a platinum anode by Llopis and Colom, and the one on the oxygen electrode in alkaline solution by Hoar, are of interest.

In addition to the papers there are quite a few pages devoted to reports of the Commissions of CITCE. Most of this material is made up of routine statements of things done or to be done by committees, individuals, or the like. The report of the Commission on Electrochemical Nomenclature and Definitions, however, is provocative and may be the most fruitful portion of the whole Proceedings. Even this, though, does not alter the doubt as to the need for this volume since such material deserves greater circulation than is provided in this way.

The most effective argument normally made for publishing a Proceeding is as a means of providing a suitable place for the discussion which follows each paper presented. In the present case the argument is of little consequence be-

cause there is a total of not more than ten pages of discussion in the nearly 500 pages of the book. Much of this meager amount is not of more than passing interest. Mechanically the volume is good, the format is pleasing, the print legible, the errors relatively few and the figures satisfactory. The text is in either German, French or English.

Such criticism as is contained in this review is not aimed at the meeting itself, which provides a useful forum for a gathering of electrochemists from all over the world, but at the form of the Proceedings which is unnecessarily expensive, ponderous, and delayed.

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Präparative Organische Photochemie. By ALEXANDER SCHÖNBERG, Professor an der Universität Kairo. Mit Einem Beitrag von GÜNTHER OTTO SCHENCK, Professor an der Universität Göttingen. Allgemeine Gesichtspunkte für die Präparative Durchführung Photochemischer Reaktionen. Springer-Verlag, Heidelberger Platz 3, Berlin-Wilmersdorf, Germany. 1958. xii + 274 pp. 16×23.5 cm. Price, DM 58.—.

Recent years have seen an increasing interest on the part of organic chemists in the field of preparative photochemistry. The appearance of a major work on this subject will be welcomed not only by workers in this field but by organic chemists in general who wish to become more familiar with the potentialities of photochemistry as an agent in organic synthesis. The author is well known for the contributions to this subject which have originated from his laboratories at the University of Cairo during the past fifteen years.

No claim is made in this book to furnishing a complete survey of all organic photochemical reactions. The aim has been to assemble in a systematic manner those reactions which have at present, or may be expected to have in the future, preparative value. The result is a well documented and critically selected compilation of reactions, written specifically for the organic chemist, with detailed experimental procedures for each type of synthesis described. No mention is made of rates or of purely kinetic studies, while mechanisms, though often presented, are usually given without elaboration or detailed comment. The synthesis of polymers is not discussed.

A short contribution by G. O. Schenck summarizes very briefly some of the theoretical aspects of photochemistry which have a bearing on the subject and contains information on light sources which are available in Europe as well as useful descriptions of glass apparatus for preparative work.

The main impression gained by this reviewer is of the thoroughness with which the literature has been covered. Approximately 300 syntheses are described in detail, while further data are summarized in tabular form. Literature up to October of 1957 has been included. Author and subject indexes appear to be comprehensive while useful cross-references are provided in the text and at the end of appropriate chapters.

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Gmelins Handbuch der Anorganischen Chemie. Achte Völlig Neu Bearbeitete Auflage. Germanium. Ergänzungsband. System-Nummer 45. E. H. ERICH PIETSCH, Editor. Verlag Chemie, G.m.b.H., (172) Weinheim/Bergstr., Pappelallee 3, Germany. 1958. xlv + 576 pp. 17.5×25.5 cm. Price, Kart. DM 332.—; Geb. DM 337.—.

This, the large supplement to the small 1931 volume on germanium, has the "now-familiar style and organization" of the other *Handbuch* volumes. Like them, it is costly, magnificent, encyclopedic, monumental—"the 'Bible' of the inorganic chemist." To this compendium of opinions expressed by previous reviewers of *Gmelin*, let me add the equally applicable words of one who had a way with words: "Infinite riches in a little room." Riches thus com-