# BOOK REVIEWS

**Annual Review of Physical Chemistry.** Volume 2. By G. K. ROLLEFSON, Editor, University of California, and R. E. POWELL, Associate Editor, University of California. Annual Reviews, Inc., Stanford, California. 1951. ix + 462 pp. 16.5 × 23 cm. Price, $6.00.

In 1904, the year of publication of the first Annual Report on the Progress of Chemistry, by the London Chemical Society, it was possible for one man to make an authoritative survey of the whole field of physical chemistry. Of the twenty-eight pages devoted to it, almost one-third dealt with various aspects of electrolytes, ions and conductivity in solution. The study of atomic structure was summarized in half a page devoted chiefly to a description of "an electrical theory of the structure of the atom put forward by J. J. Thomson" in which "he assumes an atom to consist of a large number of negative electrons in a sphere of uniform positive electrification." Even in 1926, in which the first volume of the Survey of American Chemistry was published, it could be said (p. 206) that of twenty-five American publications in the field of photochemistry, "all save two or three have come from the laboratories in Cambridge, Madison, Berkeley, Pasadena and Princeton."

The author index of the present volume, restricted as it is to physical chemistry for the year 1951, contains approximately 2500 names and 4000 references. It is tempting to extrapolate from 1904 to 1951 on, and obtain an astronomical number of references to be included in, for example, The Annual Review of Physical Chemistry for the year 2000. Fortunately, however, the causes of the spectacular increase, which are first the pressure on practically all scientists to publish and second, the vastly increased support coming to chemistry from both governmental and private sources will not increase indefinitely. Indeed, the first cause has probably reached its maximum and will diminish if wiser counsel prevails. The second cause will undoubtedly increase since chemistry is a highly applicable science. If we think of an imaginary graph showing the number of papers, plotted against their quality and if the first cause predominates, the resulting "low temperature" Maxwellian curve will have a high peak. Unfortunately, no matter how much emphasis we place on quality, we must face a situation in which the many and the few are mixed.

The Annual Review of Physical Chemistry is a scholarly production that, now more than ever, is a necessity to the productive scientist. In it the physical chemist will find a brief but authoritative survey not only of the literature in his own field but in all the other branches of physical chemistry whether related to his own field or not.

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**Combustion, Flames and Explosions of Gases.** By BERNARD LEWIS, Ph.D. (Cantab.) and GUENTHER VON ELBE, Ph.D.(Berlin), Physical Chemists, Explosives and Physical Sciences Division, U. S. Bureau of Mines, Pittsburgh, Pennsylvania. Academic Press, Inc., Publishers, 125 East 23rd Street, New York 10. N. Y. 1951. xix + 795 pp. 17 × 23.5 cm. Price, $13.50.

The second book with this title by the same authors, the present volume does for the chemist, physicist and engineer today, what the previous volume did in 1938, namely, attempt to provide a "scientific basis for understanding combustion phenomena." The developments in the intervening years have necessitated new treatments and new points of view of old problems. The present volume is therefore a new book and not merely a new edition of the old book.

The kinetic treatment in the five chapters of Part I is an application of chain reaction theory in general and specifically to the oxidations of hydrogen, of carbon monoxide and of hydrocarbons. To understand the rate of a chain process, the rates of initiation, propagation and termination must all be known equally well. There has been a tendency, especially in the Semenov school, to overlook or minimize the importance of initiation. Less effort has been made to identify the initiator of the chain and its rate of production than has been paid to propagation and termination. The authors claim "the mechanism of the thermal reaction between hydrogen and oxygen is now rather well established" and yet "in clean silica, pyrex or boric-acid-coated vessels the reaction rate is . . . (writers' italics) *erratically* dependent on *obscure* changes in the condition of the surface" which are then attributed to different chain-breaking efficiencies. Again "there is miscellaneous evidence that the pretreatment of surfaces . . . sensitizes the hydrogen–oxygen reaction" with the suggestion that "in such experiments the chain breaking efficiency of the surface is reduced." After perusing the welter of mathematical equations whereby a second and third explosion limit occur because a certain equation has two real roots, almost as though the reacting molecules had no interest in the matter, one is led to ponder carefully how much chemistry is being overlooked. The work of Oldenberg and of McLane suggests that hydrogen peroxide is a principal product, not merely a transient intermediate. Could it be that the steady-state treatment is no more applicable here than it is in hydrocarbon oxidation? It is unfortunate that in writing on a subject which is in active development, the risk must always be taken that discoveries made during actual publication may bring an entirely new complexion to a problem. This is somewhat true of hydrocarbon oxidations during the past two years. The work from the Shell laboratories in Emeryville, California, presumably came too late for inclusion in the text.

In Part II, though much still remains unknown or doubtful, the advances of the past ten years have already provided a much clearer picture of combustion and detonation waves, especially from an ignition source, which is reasonably quantitative. The 417 pages of this section are a book in themselves, admirably presented, beautifully illustrated and very worthwhile not alone to a worker in the field but also to a casual reader.

The minimum requirements for the statistical calculations of thermodynamic functions leading to estimates of explosion conditions in several systems are presented in Part III together with a treatment of radiation from flames. Part IV deals with technical problems in industrial heating and in various engine cycles. Three appendices comprising thermochemical data, inflammability limits and flame temperatures form a useful compilation for reference. The book is a mine of literature references, is clear in print and almost devoid of errors; the penultimate word on page 61 is strange even from a product of Cantab.

Whatever criticisms may be inferred from this review are not criticisms alone of the authors but of many today, who in solving a complex problem piecemeal, lose sight of the whole problem and are satisfied with answers to some parts of it. They reflect too on those, doubting the validity of these answers in respect to the whole problem, find neither the time nor inclination to test their own doubts. The authors have rendered a service in presenting the mass of material accumulated to date and in offering an interpretation of it. The service will be the greater should it prompt the unbelievers to further experiment.

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