CHEMICAL REACTION IN THE ELECTRIC DISCHARGE

The Electrochemistry of Gases and other Dielectrics

By Prof. G. Glockler and Prof. S. C. Lind. Pp. xiii+469. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1939.) 30*s*. net.

THE appearance of this first book on the electrochemistry of gases will be welcomed by a wide circle of physicists and chemists, who will also remember that one of the authors has written the first book on a related subject, namely, reactions initiated by α-particles. This book is the more welcome because of all the chemical writers on electrochemistry, none since Löb in 1905 appears to have found the part of the subject relating to gases of sufficient importance to devote to it more than a trivial portion of a book, despite the very extensive literature on the subject. Physicists writing on discharge phenomena, with the exception of Stark in 1902, are even more disappointing, for all the later writers have either omitted to mention the subject or dismissed it in a few lines.

The book was written at the request of the Committee of Electrical Insulation of the American National Research Council, and attempts to cover the field "considering all forms of electrical discharge and all types of reactions"; it contains, however, no more than three pages relating to industrial applications, vitamins, insulation, and lubricating oils.

There are three main sections in the book. Part 1 is entitled "Typical Reactions in Various Forms of Discharges"; its theme is illustrated in 139 pages by what the authors describe as a "quite arbitrary" selection of reactions which have been examined in one or more of the known types of discharge, including slow and fast electron beams. The last section is devoted to an account of the properties of molecular fragments as observed *outside* the discharge in which they are formed.

Part 2 deals in 190 pages with "Chemical Reactions in Electrical Discharges" and attempts to cite "most of the reactions that have been studied", which claim for the most part is well substantiated. The formidable task of arranging the very heterogeneous material from some 656 references in this section alone has been dealt with by considering the reactants in ascending order of atomic weight; in some cases, this has led to the dissemination of the information concerning the formation and decomposition of a given substance through several chapters.

Part 3 is entitled the "Physical and Theoretical Aspects of Discharge Reactions". The first three chapters deal with electron affinity, ion mobility, and a list of the ions observed in discharges. Then follow two interesting chapters on ionization produced by reaction, and on sputtering. The book closes with a chapter on the mechanism of discharge reaction.

Considered as a whole, the great value of this book derives from the fulfilment of the authors' aim to compile the vast mass of experimental data so as to facilitate the comparison of the various forms of discharge reaction, both amongst themselves, and with reaction initiated in the same systems by other agencies. This will be invaluable to all investigators of discharge phenomena, whether chemists, physicists or engineers. It should be a powerful stimulant to further exploration of the field, both experimentally and theoretically; and it may be that even the industrialist will be attracted to consider the possibilities of some of the remarkable syntheses that are described. It is, however, difficult not to feel a slight and perhaps ungracious sense of regret that, having such familiarity with this enormous collection of information, the authors have not essayed a more critical commentary on the relative value of their material.

Only fourteen pages are allotted specifically to the chapter on the mechanism of reaction, although most of the attempts to formulate a theory are mentioned either there or elsewhere in the book. The accounts of the various theories are, however, rather uneven; for example, Kirby's quantitative theory of positive column reaction is barely mentioned, whilst much of Warburg's work is given in detail. The authors themselves have chosen to discuss reaction mainly in terms of the ion cluster theory for reasons of "simplicity and personal acquaintance". The statistical approach to the quantitative theory of discharge reaction is, however, a little surprisingly dismissed without even formal statement, for the unproved and possibly irrelevant reason that it is impossible in this way to explain certain facts concerning reactions initiated along α-particle tracks.

The book is beautifully produced, readable, and illustrated with numerous clear diagrams; there are good author and subject indexes.

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