SCIENTIFIC BOOKS

ELECTRICAL DISCHARGES IN GASES

Fundamental Processes of Electrical Discharges in Gases. By LEONARD B. LOEB. Pp. xviii + 717. 297 figures. New York: John Wiley and Sons, Inc. 1939. $7.00.

IT is the author's objective to present "the reader with the facts and conflicting views, and . . . thereafter throw the weight of his authority in whatever direction it should, in his opinion, go, giving his reasons in each instance." This aim establishes the tone of the treatment, which is refreshingly outspoken. There is always a full discussion of the facts which form the basis for the author's judgment. The style is clear and incisive.

The presentation has been systematized in a way that is a real help in grasping essentials in a situation. Advantages and disadvantages of a method, assumptions underlying a theory, alternative mechanisms in a process, and so on, are throughout consistently listed seriatim, 1, 2, 3, etc.

The detailed treatment accorded to many of the methods, particularly those used in investigating the properties of ions, gives the book almost the character of a laboratory manual in places.

The first three chapters as well as the sixth are devoted to ionic behavior—the measurement of ionic mobilities, the experimental data and mobility theory, the recombination of ions, their diffusion, and the formation of negative ions. This amounts to one third of the book. The author's great interest in ionic behavior has led him to go into historical and experimental details which would be in place in a monograph on gaseous ions. Here they distract attention from other aspects of gas discharges and even crowd some of these out.

A chapter on electron mobility serves as an introduction to a thorough treatment of the energy distribution in an accelerated stream of electrons. The Druyvesteyn, Morse-Allis-Lamar and Smit derivations are all given. The important effect of electron interaction in creating a Maxwellian distribution in glows and arcs is, however, only mentioned in one sentence and a single reference. Nor is the effect mentioned of the positive ions in a plasma in decreasing the electron mobility.

The important subject of probes is competently discussed, and is concluded with a pertinent section on sources of error in probe measurements. The author is slightly handicapped, however, because the space-charge limited current problem and allied problems are postponed to a later chapter, with no perceivable advantage.

Ionization by electron collision is treated statistically and the relation is derived between Townsend's α and the differential ionization just above the ionization potential. But the general course of the differential ionization curve as well as values of total ionization and the formation of multiply charged ions are not discussed.

Another chapter is devoted to the second Townsend coefficient. It includes a critical discussion of spurious effects and summarizes alternative explanations.

An excellent treatment of sparks in the penultimate chapter is divided into three parts: theory, techniques in study and special types of breakdown including, among others, vacuum sparks, corona and lightning.

One reaches the final chapter on glows and arcs realizing that although one of the important applications of electrical discharges is to lighting, there has been no treatment of excitation and radiation.

Unfortunate confusion arises in this last chapter between glow and arc, and low and high pressure discharges. A "positive column" section under the glow discharge really deals with the low-pressure glow *or* arc, while a similar section under arcs deals with the high-pressure arc. The same is true of the two "anode fall" sections. Thus, the generally false impression is created at this point that arcs can not be low-pressure affairs and that they can not have low current densities.

This chapter is inadequate in other respects. The low-pressure positive column in which ions fall, without impact, to the wall is not mentioned although it has had far better experimental confirmation than the quasi-neutral diffusion case. It would be desirable to know what the effect is of a magnetic field on the arc and that current limiting factors exist. Of comparable importance to sparking is the disappearance of ionization after the interruption of an arc and the application of such de-ionization to the thyratron principle, but this is not discussed.

There are three appendices, one on the kinetic nature of a gas, the others consisting of a table of critical potentials and a table of physical constants.

The extremely comprehensive author and subject indices as well as the wealth of direct references are valuable features.

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THE ULTRACENTRIFUGE

The Ultracentrifuge. By THE SVEDBERG and KAI O. PEDERSEN, in cooperation with J. H. BAUER, E. G. PICKELS, G. BOESTAD, E. O. KRAEMER, J. B. NICHOLS,