BOOK REVIEWS

Plasmas and Controlled Fusion. By David J. Rose and Melville Clark, Jr. 493 pp. The M.I.T. Press and John Wiley & Sons, Inc., New York, 1961. $10.75. *Reviewed by Howard Chang, Stanford Research Institute.*

PLASMA physics is the protean and fashionable discipline concerned with the behavior of systems composed mainly of electrons and ions in which the electromagnetic forces between the charged particles and the effect of electromagnetic fields and boundaries that may be present are important in determining the behavior of the systems. Since many people now use the term "plasma physics" synonymously with such venerable branches of physics as surface-gas interactions, gaseous discharges, arc discharges, glow-discharge phenomena, and electron-beam dynamics, and with such novel fields as controlled thermonuclear fusion, ion and plasma propulsion, cosmic and ionospheric physics, and magnetohydrodynamics, the use of the adjective "protean" to characterize plasma physics is fully justified. The adjective "fashionable" is used advisedly, since the number of people actively engaged in plasma physics and the number of papers appearing on this fascinating and important subject have increased exponentially during the last decade. As proof, one can cite the appearance of several new journals devoted almost exclusively to research in plasma physics, the creation of a Division of Plasma Physics by the American Physical Society in 1959, and the establishment of plasma-physics laboratories in numerous industrial and nonprofit research organizations.

Unfortunately, plasma diagnostics is still in its infancy. That is, the models of plasma used by theoreticians are highly idealized, and almost insuperable difficulties arise in designing and performing experiments in plasma physics that can be interpreted simply and unambiguously. Consequently, plasma physics has been facetiously stigmatized as the science rich in theoretical concepts of dubious applicability.

Let it be agreed, then, that any physicist intrepid enough to attempt to write a book on such a many-splendored subject as plasma physics is faced from the outset with an embarrassment of riches. If he is not to spend a lifetime writing a tome as large as a volume of the *Encyclopedia Britannica*, he must exercise discretion and genius in carefully selecting the topics that he will cover in his book. Once the important decision of subject matter has been skillfully made, he must possess the technical competence and literary gift to write with clarity and diligence on each subject and carry each discussion to a logical conclusion dictated by the limitations of space and human knowledge. In short, it is inevitable that in any book on a "many subject" discipline such as plasma physics, there will be sins of omission and sins of commission.

To be sure, at this late date there is no dearth of books on plasma physics. However, the serious student will have difficulty in finding a book that leads him straight to the heart of the subject and gives him power to apply its concepts intelligently. He refuses to be bored by diffuseness and general statements which convey nothing to him and will not tolerate a pedantry which makes no distinction between the essential and the nonessential. As mentioned earlier, much of the difficulty is due to the fact that plasma physics is so many different things to different people, and the only way out of this dilemma is to write books on "Plasma Physics for Experimentalists" and "Plasma Physics for Theoreticians" and, if the writers of college outline series ever get hold of this field, "Plasma Physics without Calculus".

It is always an unalloyed pleasure to review a superbly written textbook, and *Plasmas and Controlled Fusion* obviously belongs in that enviable category. It is an authoritative, carefully written, lucid, and up-to-date book on classical plasmas and the problems of controlled thermonuclear fusion. (In a classical plasma the particles are considered to possess no internal degrees of freedom, and the average electrostatic potential between the charges is much less than the mean thermal kinetic energy.) A graduate textbook, it presupposes the usual undergraduate courses in atomic physics, differential equations, electromagnetism, and thermodynamics. In a space of less than five hundred pages, it contains almost everything in Spitzer's classic, *Physics of Fully Ionized Gases*, in an expanded and intelligible form, the gist of Delcroix's tract, *Introduction to the Theory of Ionized Gases*, most of the material in Chandrasekhar's admirable book, *Plasma Physics*, a good treatment of hydromagnetics, and an excellent summary of recent approaches to controlled fusion and energy recovery from hypothetical systems. Additionally, it contains a very detailed, valuable, and readable account of plasma stability, devices based upon the pinch effect, mirror-like devices, and the stellarator. The problems at the end of each chapter supplement the text and add considerable value to the book.

Anodic Oxide Films. By L. Young. 377 pp. Academic Press Inc., New York, 1961. $11.00. *Reviewed by H. A. Liebhafsky, General Electric Research Laboratory.*

IN the desperate hunt for materials to meet the increasingly severe demands imposed by modern civilization, the more exotic metals continue to receive major attention. It is a truism that with most