

temperate zone, water-soluble silica can be extracted from soils, and is therefore presumably hydrated. The remarks about the colour changes of hydrous iron oxides on dehydration are open to question, for it is a fact that in many red soils goethite is the main identifiable form. Crystal growth is a more probable explanation of the colour changes. The iron oxides in a braunerde are said to be flocculated, and therefore immobile, so that concretions do not form (Kubiens, p. 234), but Dr. Cornwall allows them to be "typically seen in braunerde" among others. This may be true if one uses the more general expression 'brown earths'. Such concretions formed in the earlier history of the soil do not necessarily shrink and become deformed (p. 191) but may retain their shape and structure. Again, a braunerde does not necessarily become degraded to a podzol on increase in acidity; unless heath intervenes, a form of soil lessivé is a more likely result.

The author's descriptions of laboratory techniques are unorthodox but in general probably adequate. In mechanical analysis, however, it is better to use 'Calgon' systematically unless the coarser fractions are examined for aggregates of silt and clay. The removal of gypsum is readily effected by ammonium acetate. In the method for the determination of  $pH$  (p. 166) the proportion of soil to water is surely a misprint. Under iron, mention might have been made of a method for 'free' iron oxide, the determination of which is commonly more useful than total iron. It should also be pointed out that a sharp increase in total iron in the subsoil does not necessarily indicate podzolization, for this effect is shown by grey-brown podzolic soils (sols lessivés). The observed variation in  $pH$  with depth in this group of soils (also in some tropical soils), namely, a minimum value in the lower *B* horizon, suggests an alternative explanation of the results of the Mersea section (p. 207). The top of the decalcified layer could well be the surface of the buried layer rather than the point of minimum  $pH$  as seems to be assumed by Dr. Cornwall.

A pioneer effort like this book must inevitably have its defects, but the author has made a valiant attempt to provide a bridge between two disciplines that should lead to valuable results in the future. ALEX MUIR

## SEMI-CONDUCTORS

### Solid State Physical Electronics

By Prof. Aldert van der Ziel. Pp. x + 604. (London: Macmillan and Co., Ltd., 1958.) 37s. 6d. net.

THE expanding use of semi-conductor and dielectric devices during the past decade or so has been so rapid and widespread that there now exists in the design and applications of these devices what is virtually a new branch of electrical engineering. The development of these devices has been accompanied by the publication of a number of books written primarily to provide accounts either of the special circuit techniques involved in their use or of the relevant aspects of solid state physics. However, this book provides a new approach by aiming at giving an understanding of the operation of solid state devices. The book attempts to cover this whole field in a single volume designed to fill the need for a collected and concise account of the exploitation of the physics of the solid state over the whole of this rapidly expanding subject.

The first five chapters of the book deal briefly with the relevant basic physics required. Topics which are

discussed include particle and wave aspects of light and matter, particle statistics, and the structure and band theory of solids. The next six chapters form a section dealing with the various mechanisms of electron emission from solids, and the design and characteristics of relevant devices such as thermionic vacuum tubes, photo-tubes, and secondary emission multipliers; approximately half this section is devoted to thermionic emission and its applications. The physical principles and operation of the more important semi-conductor devices are treated in the next six chapters. Metal to semi-conductor rectifiers and photo-effects in semi-conductors occupy one chapter each, but most of this section is concerned with a relatively extensive treatment of the junction diode and in particular the transistor and its equivalent circuits. Dielectric and magnetic materials and their applications are dealt with in the remaining six chapters. Topics discussed here include luminescence and the light amplifier, transducers, ferroelectricity and the dielectric amplifier, the solid state maser, and ferrite devices.

It is inevitable that, in covering so wide a subject in a single volume, some applications have to be omitted; for example, no mention is made of parametric amplification. The discussion of topics included is necessarily curtailed although each chapter is followed by a short list of references to original literature and additional texts for supplementary reading. Formulae required are sometimes quoted without derivation, for example the equations for Fermi-levels in semi-conductors given on p. 90; and physical concepts are sometimes introduced without discussion of their background, for example the introduction of thermodynamic free energy on p. 511. However, since the emphasis of the book throughout is on providing an understanding of the operation of devices rather than on giving a detailed exposition of fundamental solid state physics or circuit engineering, this is not necessarily a disadvantage.

The book is well written and printed, and is easy to read although the large number of extensive footnotes employed does tend to break up the reading of the text. Unfortunately, the value of the book is reduced slightly by the presence in it of a number of minor errors such as observations in the text which disagree with the relevant diagram, for example the Fermi-level in Fig. 12.3*b* is raised and not lowered; numerical magnitudes given wrongly, for example the spontaneous polarization of barium titanate given on p. 526 should be about  $0.26 \text{ C.m.}^2$ ; and misprints in the text such as the Fermi function on p. 51 and the thermoelectric power quoted for metals on p. 463. Most of these are trivial but do cause some confusion and irritation.

As is the growing practice in this field, the book utilizes the M.K.S. system of units, includes a useful short table of fundamental physical constants, and gives a number of representative problems, with answers, at the end of each chapter.

To the student of engineering or physics, this book provides a useful and comprehensive introduction to the many different ways in which solid state physics is at present being exploited; to the specialist worker in this field the book will serve as a reminder of the very wide ramifications and potentialities of his subject. Notwithstanding the various criticisms made here of this book, there is no doubt it is an important publication and can be recommended widely.

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