

Semiconductor physics

Andrew K. Jonscher

Semiconductor Physics. By P. S. Kireev. Pp. 693 (MIR Publishers/Central Books: London, 1977.) £5.95.

THIS is an interesting novelty — a translation from Russian into English made and published in the USSR and offered at the bargain price, by any standards, of less than six pounds for nearly 700 pages in hardback. The first point to make is that the translation is remarkably good coming from a non-native English speaker and it would be churlish to quibble over small points of odd usage of English. That aspect is quite satisfactory.

The material is organised into the following chapters (with numbers of pages): introduction (31), band theory (138), electron and hole statistics (54), kinetic phenomena (135), scattering theory (92), recombination (36), contact phenomena including p-n junctions (35), optical and photo-electric phenomena (101), Appendix — group theory (61). The size of the chapters reflects fairly closely the Author's predilections and the strong points of his expertise, which evidently centre on theory; all treatment of 'concrete devices' is excluded. The quantum mechanical treatment of the band theory of solids is very thorough — certainly at postgraduate level — and includes the effects of magnetic fields, surfaces and point defects, but not strongly disordered solids. Simple examples of band structure calculations are also included. Carrier statistics is treated conventionally, includes a lot of detail and covers, in particular the quantisation in high magnetic fields.

The treatment of transport begins with Boltzmann's transport equation — going into considerable detail with tensor effective masses — and includes the treatment of galvanomagnetic phenomena, especially the Hall effect, heat conductivity and thermoelectric effects. It is noteworthy that frequent examples are given of experimental data to illustrate particular developments in the theory. The principal carrier scattering mechanisms are described in considerable details, and a rather unusual feature of the book is that lattice vibrations and specific heats are dealt with as a sub-section of this chapter. There is a brief treatment of high-field effects and deviation from Ohm's law, but this general subject is treated in a rather disappointingly sketchy manner and manages to give a confusing picture of the Poole, Stark, Poole-Frenkel and Zener effects. The important topic of transferred

electron phenomena receives barely one page and one not very informative diagram: — one would have expected more after the very thorough preparation in earlier chapters. There is nothing about effective carrier temperatures in high fields and band-to-band avalanche multiplication, and saturated drift velocity is shown in a diagram but is not discussed in any detail.

After the very detailed treatment of the band theory, the presentation of the physical aspects of carrier recombination is decidedly perfunctory and the subject of minority carrier injection does not receive any significant amount of attention, either at the level of analysis or of a physical description of ambipolar flow and preservation of neutrality. The chapter devoted to contacts includes a very sketchy description of the p-n junction but the voltage-current characteristics of neither of these are derived. This is perhaps taking the avowed aim of excluding devices a little far, as the I-V characteristic may be considered to be both fundamental to the theory of semiconductors and highly illuminating physically of a range of transport phenomena.

By contrast with the above, optical and photoelectric phenomena are treated again quite thoroughly, especially free carrier absorption, cyclotron resonance, plasma reflection, intrinsic absorption in considerable detail, lattice absorption and impurity absorption. Likewise, photoconductivity, photovoltaic effects and photoelectromagnetic effects are given reasonably good coverage, with illustrations relating to experimental results.

There is an appendix on group theory which is useful for the beginner, although the precise logic of including this rather than any other supporting material is not obvious. A good feature of the book are the brief summaries at the end of each section which should be useful for revision and for rapid scan of the principal features.

Although carefully selected passages of this text would be suitable for an undergraduate course, the treatment is definitely postgraduate, and rather specialised at that. The book is literally packed solid with information — the typographical layout is very condensed, with 46 lines to a page of slightly smaller format than an equivalent Western text with 38 — 39 lines. Similarly, mathematical expressions, of which there is a great deal, are tightly packed in the text and most of the diagrams are very small by our standards. Thus, although the reading process may be more tiring, the book contains a good 20% more information per page than its equivalent here.

The quality of paper is not high — especially as the book is liable to get thumbed readily in extensive usage. A very serious defect — not untypical of Soviet books — is the omission of an index, especially in a text that is more likely to

serve as a reference source rather than as a regular reading text.

Altogether, a very mixed impression. A first-class bargain in terms of the sheer quantity of information per pound sterling, good coverage of theoretical aspects such as band theory, transport and optical phenomena, but quality of treatment falling off rapidly in other areas. In those areas in which it is strong it should form a good reference source, although I would dread having either to teach or to read a course of that level of detail. Perhaps the publishers may be able gradually to take into account the different standards of presentation normally expected in the West, thus further increasing the attractiveness of the product, even if that meant raising the price by as much as 50% — it would still remain a bargain! □

A. K. Jonscher is Professor of Solid-State Electronics at Chelsea College, University of London, UK.

Yeast identification

B.H. Kirsop

A Guide to Identifying and Classifying Yeasts. By J.A. Barnett, R.W. Payne and D. Yarrow. Pp. 315. (Cambridge University Press: Cambridge, 1979.) £32.50.

THE yeasts are a heterogeneous and important group of organisms which are widely distributed, commonly isolated and often in need of identification. This *Guide* has been written to help overcome difficulties in identification and is intended to be used in conjunction with the standard work (*The Yeasts*, edited by Lodder, North Holland, 1970). Those experienced in yeast identification will meet little difficulty and so the present work must be judged by the extent to which it helps the inexperienced.

The *Guide* provides condensed but useful descriptions of methodology and of the principles of classification. It lists the salient properties of each genus and provides a particularly valuable tabulation of the major physiological and morphological attributes characteristic of each species. Identification is based on keys, a general one being provided for yeasts as a whole; there are also special keys to smaller groups, such as those likely to occur in particular habitats or those possessing specific morphological or physiological attributes. Testing with unnamed yeast showed that the keys are easy to use and readily yield names. In a