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Handbook on the physical properties of Ge, Si, GaAs and InP byA Dargys and J Kundrotas

Handbook on the physical properties of Ge, Si, GaAs and InP. A Dargys, I Kundrotas (Vilnius, Lithuania: Science and Encyclopedia Publishers, 1994) 262 pp.
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The handbook under review provides up-to-date information on the basic physical parameters of two elementary (Ge and Si) and two compound (GaAS and InP) semiconductors.

The introductory section presents a reasonably detailed discussion of the current view of the band structure and major electrical and physical properties of crystalline semiconductors; tables of major physical properties and the relation between CGS and SI numerical values are also given. The publication of this introduction as a brochure or an appendix to Soviet Physics-Semiconductors, whether in the original English or in a Russian translation, is likely to attract considerable specialist interest in Russia.

The semiconductors covered are quite a natural choice as far as Ge, Si, and GaAs are concerned, because many remarkable properties of germanium made it a very convenient material at the early stages of modern semiconductor physics and solid-state electronics. [The electrical and physical data on Ge open the main part of the book (pp. 31 – 73)]. Perhaps the most favourable factor was the relative ease of growing large pure single Ge: crystals a research area, parenthetically, in which the reviewer himself was involved from 1952 – 55. For many years since then, and indeed in the course of the 1990s, single crystalline Ge has been the most suitable object for the fundamental studies of phenomena such as the condensation of nonequilibrium charge carriers to 'electron-hole drops', predicted by L V Keldysh. Compared to the well-known handbook of Landolt-Börnstein†, the present volume contains new important data for many researchers who continue to investigate the fundamental phenomena in semiconductors. It should be noted that while covering single crystalline properties of Ge, Si, GaAs and InP, the handbook fails to include the properties of their amorphous phases. This should not be considered a shortcoming, though, since unlike perfect single crystals, amorphous phases exhibit a wide variety of forms whose study has not yet reached a level at which reliable quantitative parameters could be given.

At the end of the single crystalline Ge section, detailed tables of the energy levels of major electrically active impurities are given together with appropriate literature references (from p. 73 on).

Section II (pp. 83 – 130) presents data on the band structure and energy spectrum of single crystalline silicon. At present, about 98% of all active elements of solid state electronics are known to be manufactured on the basis of this material. The technology of growing huge Si single crystals (up to 150 mm in diameter and 57 – 75 cm in length) has nowadays achieved a high level of perfection. The content of this section will undoubtedly be of much use for specialists in Russia and Belarus', where extensive work is being carried out on the design of silicon devices. As is the case with the Introduction, it seems that modern electrical and physical parameters data on silicon should also be made accessible to a wide range of Russian specialists in the near future, whether through publishing this section in Russian or re-editing it in the English original. It should be noted that the book fails to cover the technologically important data now available on major point defects occurring in Si and on their complexes with impurities, nor does it contain information about the energy spectra of local centres at silicon interfaces with SiO_2 and other substances. Since almost all silicon devices are planar structures at present, the energy spectra of near-surface local centres are of crucial importance for practical applications.

GaAs is known to be the material on the basis of which the early injection lasers were developed. The technological problems in growing large single crystals or preparing epitaxy films of GaAs has prover to be extremely difficult, and although much progress has been made, this semiconductor remains in some respects unpredictable, especially as far as long-service devices are concerned. Nevertheless, the remarkable properties of GaAs has made it attractive for interesting and practically important applications. Of particular interest is that part of Section 3 containing very detailed data on GaAs luminescence spectra. Unlike the silicon section, in the section on GaAs there is Table 3.2 presenting quite detailed data on capture centres (traps) whose nature is not yet completely understood. Note that the table fails to give literature references (the authors' own data, 3.116, seem to have been used).

The final fourth section of the book contains band-structure, electrical, and physical data on indium phosphide InP which, like GaAs, is also an A_3B_5 compound. In terms of layout, this section is similar to the preceding one. The data it presents will probably have a narrower readership compared with the previous, particularly second and third, sections.

At the end of the book there is an extensive list of references, including original publications appearing up to 1992. On the latest pages, a brief summary in Lithuanian is given. The book is of high technical quality and would undoubtedly be a welcome library addition for major scientific centres in Russia.

The reviewer has visited the Lithuanian scientific centres in Vilnius and Kaunas on many occasions and is well acquainted with the great achievements of Lithuanian physicists. The book under review is a result of serious and highly labour-consuming work. The authors are to be congratulated on the appearance of the book and wished continuing success in their future efforts.

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† Landolt-Börnstein *Zahlenwerte and Funktionen in Naturwissenschaften und Technik. Neue Serie* (Ed. O Madelung) Band 17 *Halbleiter* (Eds M Schulz, H Weiss) (Berlin, Heidelberg, New York: Springer-Verlag, 1982).

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