

Book Review

Physics, Technology, and Use of Photovoltaics

By R. J. Van Overstraeten and R. P. Mertens, published by Hilger Ltd., 1986, 278 pp., £35.

Because the world is presently experiencing a period of low oil prices, some of the urgency has apparently gone from research and development into other sources of energy. In the longer term, however, with ever-increasing energy demands and the certainty of the finite nature of fossil-fuel sources, it is imperative to maintain research to develop economically viable alternative sources of energy such as photovoltaic solar cells. The growing use of these systems in stand-alone remote-area power supply (RAPS) applications is additional encouragement to such efforts.

The book under review presents an up-to-date overview of photovoltaics for solar-energy conversion. Emphasis is directed towards cells based on silicon, as these appear to be the most likely immediate candidates for the purpose. All aspects of photovoltaic cell production are covered, from the physics behind the cell design, through the technology of cell production and the assembling of individual cells into modules, to the operation of these modules.

Clearly, this book must be regarded as a significant and comprehensive reference work in this field. In a stimulating way, discussions of the theory behind the basic devices are combined with descriptions of industrial-scale manufacturing methods for cells and modules and the subsequent use of these devices in the field. Some outstanding virtues of the book should be noted. For example, chapter 2, on the general physics of photovoltaics, assembles in a convenient package much of the modern thinking on the basic principles, and is written both with the firm grasp of the subject expected from these workers and with sufficient detail to be of genuine use to the specialist. Chapter 3 consists of an excellent treatment of the specific-device physics of solar cells for different materials, and, while it deals at some length with monocrystalline silicon, it also includes quite detailed recent information on both polycrystalline and amorphous silicon. It is a positive advantage to have such full descriptions of these last two materials in one volume.

Chapter 4, on the technology of crystalline silicon cells, is a particularly readable account of current practices, while the section in the following chapter on the technology of amorphous silicon cells makes thought-provoking reading. A chapter on optical concentration methods covers this field briefly, but in a well-structured manner. It is unfortunate that this chapter was written too late to give more than a mention to the concepts which have led to recent striking advances in cell efficiency.

The last three chapters of the book are devoted to the operation of both modules and complete systems, with a final and valuable summary of major photovoltaics systems installed around the world, and their purpose. These chapters represent the most complete and useful summary gathered in one book of the practical applications of the results of cell research, and should be compulsory reading for all those involved in the other end of cell design.

The treatment of photovoltaic materials other than silicon tends to be a little cavalier, but this is understandable given the overall success and the many attractions of silicon as a cell material. The problem of electricity storage is given a low-key treatment, concepts other than lead/acid battery storage being discussed only in passing. The section dealing with lead/acid battery storage itself is a short, though adequate summary. The brevity of the material on storage may well reflect the rather striking lack of success and innovation throughout the world in this field, in spite of its critical role in the final adoption of the photovoltaic energy source. The reviewer notes that this journal seeks to remedy this situation by inviting discussions on battery storage for RAPS applications*.

With its detailed treatment, its wealth of source material in the form of graphs and formulae, and its selective list of references providing an entry into the key literature up to 1984, this book should find regular use by specialists, who will have little trouble in finding their way around its logically-structured arrangement. The wide coverage of the field would encourage the general reader, also, to find information of a broader interest. For this purpose, however, it is not possible to rely on the index alone, for this seems to have been constructed on a rather random work-search principal. As one example of the difficulties to which this can lead, on looking up "junction" in the index, one is referred to the work "junction" on page 137 in two of its specific word appearances only, in this case in the context of the screen printing process, and not to any of the more general discussions on junctions in the rest of the text. A book of this consequence demands a much more complete and cross-referenced index.

Workers in the field will understandably ask how this book compares with the publication *Solar Cells*, by Martin Green (published by Prentice-Hall, 1982). The book under review inevitably follows a similar outline, although differing in detailed plan. It is almost 50% longer, and is about four years more recent. The strengths referred to above, give it a definite edge in these specific areas, while it has at least the same high standard elsewhere. Martin Green's book may be slightly preferred for teaching purposes, containing as it does some particularly illuminating treatments of basic problems. I would not want to be without either.

The standard of production of the book is uniformly high, with general well-chosen and well-reproduced figures, and only minor printers' errors have crept in. At the price, it is good value, and is unreservedly recommended.

*See *J. Power Sources*, 16 (1985) 205.