

faces and more. These brief but precise vignettes are well done, and the book gives the best descriptive comparison I have seen of the different classes of organic superconductors as well as a well-reasoned, fair and balanced analysis of the interpretation of the behavior of each.

The level at which the different theoretical sections are presented varies from elementary—for band models and superconductivity—to advanced—for the use of finite-temperature Green's functions to describe the field-induced spin-density waves. Not everyone is going to be comfortable with the varying levels of presentation, but in all cases the steps of the authors' arguments are well explained.

While there is a great deal that is covered in the text, there is also a great deal that is not. There is no discussion of methods of chemical synthesis, crystal growth, electrocrystallization, solid-state polymerization or any of the details of experimental methods used to determine the physical properties of these materials. The authors recognize this limitation and clearly state that they are not experts in these areas and therefore have omitted them. That is fair enough.

What is more surprising perhaps is the omission of any major discussion of the properties of polyacetylene, the polydiacetylenes, the Krogmann salts and $(\text{SN})_x$. While these are either not superconducting or, in many cases, not in the strict sense organic, they have all been part of the family of compounds that have been the focus of similar studies and have many common links to the organic superconductors.

The book contains some spelling errors that could have been caught by an alert editor, some typographic errors and some mislabeled figures, but on the whole the book is well assembled, well illustrated and has several hundred references and a comprehensive subject index. It is a welcome and timely contribution in a rapidly growing area of condensed matter physics.

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Semiconductor Material and Device Characterization

Dieter K. Schroder

Wiley, New York, 1990. 599 pp.
\$59.95 hc ISBN 0-471-51104-8

In the early 1950s, physicists first became familiar with terms such as

hole and electron concentration, Hall mobility, drift mobility and minority-carrier lifetime in connection with measurements on semiconductors. Such measurements were necessary to understand and explain both the bulk properties of germanium and silicon and the behavior of devices fabricated from those materials. In the intervening 40 years we have witnessed the birth of the semiconductor industry, which developed a variety of new materials, exploited bandgap engineering and two-dimensional structures and produced incredible numbers of discrete devices and integrated circuits.

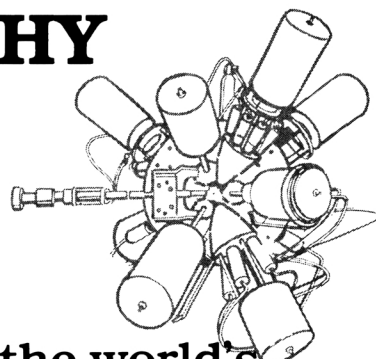
Not surprisingly, there has been a concomitant need for a greater and more widely based knowledge of material and device properties. Details of the ever more sophisticated methods and instruments associated with that goal have been documented in source papers, review papers, conference proceedings, a few now out-of-print books and several chapters appearing in various textbooks and handbooks.

Dieter Schroder recognized the need for a single comprehensive source for this information. His book unites a broad range of electrical, optical, physical and chemical techniques, while providing a guide for the uninitiated. For example, in discussing lifetime-measuring techniques, the author writes that the "topic would appear to be straightforward since the concept of electron and hole lifetimes in semiconductors is, in principle, quite simple. However, in practice, there are often as many lifetime values for a given device as there are measurement techniques—[in reality] 'lifetime' is quite a complex concept."

In addition to carrier lifetime, chapters in the book cover resistivity; carrier and doping concentration; contact resistance and Schottky barrier height; series resistance, channel length and threshold voltage; mobility; oxide and interface trapped charge; deep-level impurities; optical characterization; and chemical and physical characterization. Each of the chapters is logically constructed and complete, and all include useful appendixes.

Despite the author's diligent coverage of the field, he has omitted one important measurement technique. Acoustoelectric interactions in general and surface acoustic wave techniques in particular have been described in many publications. Fortunately, a recent article provides an excellent overview of the subject (M. Tabib-Azar, M. Abedin, M. Abbate, P.

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Das, *J. Vac. Sci. Technol.* **b9**, 95, 1991).

I believe that the book will appeal to the two distinct audiences the author set out to reach: graduate students and industry researchers who wish to become (or remain) familiar with the methods used in the modern semiconductor industry. I was impressed with the number (more than 1300) and currentness (through 1988) of the references, the clarity of

the illustrations and the completeness of the index. Above all, I was impressed with the author's writing style and his not overly pedagogical approach.

From someone who remembers with nostalgia his first encounter with the Haynes-Shockley experiment in 1952—seeing on an oscilloscope screen the passage of holes from one contact on a Ge sample to another—I highly recommend this book

to those who were there then, as well as to those who have come along since.

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Pions to Quarks: Particle Physics in the 1950s

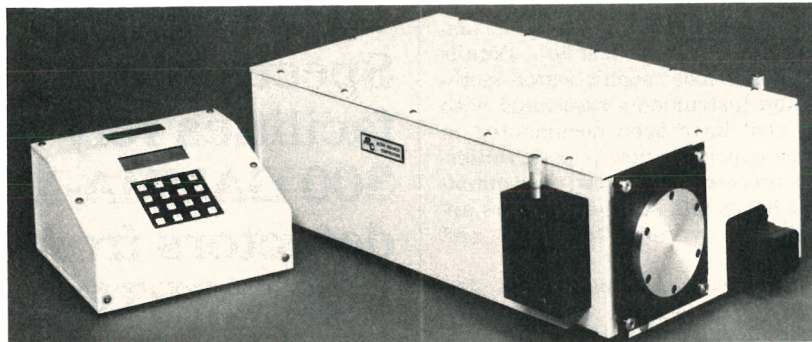
Edited by Laurie M. Brown,
Max Dresden and
Lillian Hoddeson
*Cambridge U. P., New York,
1989. 734 pp. \$59.50 hc
ISBN 0-521-30984-0*

Pions to Quarks is a collection of 47 essays based on lectures presented at a 1985 symposium at Fermilab. It is the second in a series, of which the first volume, *The Birth of Particle Physics*, covers the 1930s and 1940s. Unlike the first volume, *Pions to Quarks* includes some contributions by historians of science, though most are by physicist protagonists of the 1950s. While the volume will be a valuable source for historians, it is also fascinating reading for physicists wishing to understand the origins of today's "standard model" of the elementary particles and their interactions. Like most successful theories, the standard model is often portrayed as if it had sprung full-blown from the head of Zeus. It is marvelous to be reminded of the real story: a struggle toward a coherent theory using incomplete and confusing information, plagued occasionally by false or misleading clues.

The ample volume contains a foreword by Leon Lederman and an introductory essay by the editors—Laurie Brown, Max Dresden and Lillian Hoddeson—that are alone worth the price of admission. Lederman explains what the symposium participants have in common with a keen-sighted golf caddy named Pete (of this I can say no more). The introductory essay by the editors is a succinct overview of the period, encompassing scientific, technological, political and socioeconomic aspects of the story.

That story is very relevant to the situation of particle physics today. While the subtle interplay of theory and experiment was at work during the 1950s, as it always is, the leading role was played by experiment—as Murray Gell-Mann writes in the closing essay, there was "a close partnership of experiment and theory in a period...[of] sensational experiments." By the end of the 1940s the notion of separate weak and strong

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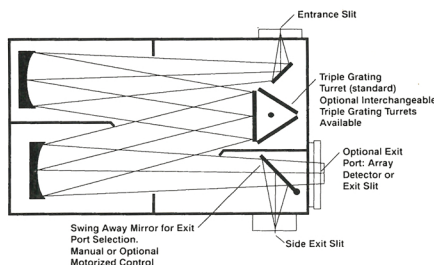


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