coupled wave equations and then the material response to illumination. It finally combines the two to describe the main dynamics of grating formation and two-beam energy coupling.

The second section, in part an annotated review of the literature, extends the analysis considerably. A long chapter reviews charge trapping and transport in real materials and their relation to photorefractive dynamics. Three more chapters describe the rich subject of dynamic multiwave interactions. The final section surveys many applications, concentrating on the big three: optical data storage, image processing and amplification and parallel computation. The final chapter includes a description of the one and only photorefractive device currently on the market, a narrow band interference filter produced by Accuwave, of Santa Monica, California. The three appendices introduce the reader to a more rigorous treatment of optical anisotropy, give a résumé of the electro-optic effect and outline techniques for determining the many material parameters found in photorefractive models.

The authors are candid about biases introduced by their experience and interests. As a result, most examples involve one particular material ($Bi_{12}SiO_{20}$), and there is substantial attention to moving gratings and AC field techniques. I would have displaced some of the latter with more coverage of *my* favorite topics—charge transport processes and photorefractive polymers—and photorefractive waveguides and liquid crystals also deserve some discussion. There is insufficient attention to the difficulties introduced by beam attenuation in nonsymmetric beam geometries and to beam fanning and spatial solitons. An annotated summary of the properties and growth of common photorefractive materials would have demonstrated the wide range of properties and helped the reader select materials for a particular experiment or device.

The Physics and Applications of Photorefractive Materials will be a valuable text and resource for many novice and experienced scientists and engineers. I learned many new and useful things from it and got a better picture of how the subject developed, both historically and conceptually.

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Fundamentals of Semiconductors: Physics and Materials Properties

Peter Y. Yu and Manuel Cardona
Springer-Verlag, New York, 1996.
617 pp. $49.95 pb
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Those who have taught graduate courses in semiconductor physics have often had to struggle with the appropriate selection of topics, what with the proliferation of new physics, new structure fabrications and new device applications. The authors of *Fundamentals of Semiconductors*, Peter Y. Yu and Manuel Cardona, have wrestled with the very same problem in courses they have taught, and they have come up with a concise and yet satisfactory list of topics. The most striking feature of their book is its modern outlook: a long chapter on both the electron and phonon properties in heterostructures, a survey of growth techniques and a discussion of the influence of defects on electronic properties. All of the

basic knowledge needed to appreciate the fundamentals of semiconductors is covered: electrons and phonons and their interaction, transport and optical properties.

Fortunately for the readers, the authors follow the bias of their expertise and give us an authoritative introduction to light-scattering and photoemission. They did not use all of their research expertise, however; they left out, for example, much of high-pressure physics. Not all instructors will be satisfied with their selection of topics. For those who want more transport than optical properties, there is *Semiconductor Physics: An Introduction* by Karlheinz Seeger (Springer, sixth edition, 1997). For those who prefer a more device-related exposition, there is *Fundamentals of Semiconductor Theory and Device Physics* by Shyh Wang (Prentice Hall, 1989). For those who feel nonlinear optics is more than just Raman scattering, there is an opportunity to write a book as the semiconductor counterpart to *Principles of Nonlinear Optical Spectroscopy* by Shaul Mukamel (Oxford U. P., 1995).

I would advise the student not to worry too much; Yu and Cardona's book provides a wonderful foundation. A student who wishes to learn about semiconductors and who has a basic preparation in quantum mechanics and electromagnetism should enjoy and benefit from this introduction to semiconductors. Of course, a first course in solid-state physics would be helpful, but I have a feeling that it is not absolutely necessary.

The most wonderful feature of the book is its efficient style of exposition. It brings the reader to the point where the knowledge is used the way the practitioners would use it. The treatment of Raman scatterings by phonons covers all basic aspects: theory, experimental techniques and actual spectra. It brings the reader in one step to readiness to use Raman scattering. I applaud the introduction of Feynman diagrams as a qualitative tool for understanding of the scattering processes and wish only that the diagrams included the electron and hole lines to represent the details of the associated electron excitation processes. The discussion of group theory is not just a quick remedial course for the uninitiated but is also effective for showing students who have had a group theory course how it works in practice.

A nice touch is the appendix, "Pioneers of Semiconductor Physics Remember . . .," which offers the insights from a constellation of key contributors to semiconductor physics, who discuss topics they know deeply. These should inspire students and enlighten practitioners. The book is handsomely produced; its juxtaposition of red and black colors is pleasing to the eye and adds to the clarity of presentation.

As the duty of a reviewer includes fault-finding, I could risk being thought churlish to mention some minor oversights, such as the description of quantum wells as structures containing a layer of less than 1 nm in thickness or the omission of one or two key references. One criticism that I will make without apology is the cartoon of a "semi-conductor," which is hardly Dilbertian.

In sum, if you are a student who wants to add semiconductor physics to your armory or are an instructor or a researcher who wants to look up some basic points, this is an excellent book with which to start.

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