to study such refractory topics as the ranking system, where a language (or two) and a new set of cultural norms must be learned. The adaptation of the necessary research strategies to a strange locale is a difficult, lengthy, and subtle process. And the informants are not accustomed, as we are, to survey research. Thompson has utilized a relevant and important sampling strategy, and has attacked serious problems with determination and skill. His book deserves to be read with respect and care, for it has much to offer.

ROBERT C. HUNT
*Department of Anthropology,*
*Brandeis University,*
*Waltham, Massachusetts*

## Altering Surfaces of Solids

**Ion Beams.** With Applications to Ion Implantation. ROBERT G. WILSON and GEORGE R. BREWER. Wiley-Interscience, New York, 1973. xii, 500 pp., illus. $19.95.

Ion implantation is gaining wide acceptance in both science and industry as a new technique for altering the near-surface properties of solids. Materials scientists are finding that many of the physical constraints (such as solubility limits and diffusion rates) imposed by normal materials preparation techniques can be circumvented by ion implantation because it is a nonequilibrium process. Solid state researchers are gaining new insights into the electrical, mechanical, chemical, optical, magnetic, and superconducting properties of solids that have been selectively altered by implanting controlled amounts of impurities from an ion accelerator. Firms in the semiconductor industry are finding that ion implantation is a powerful and economically superior technique for fabricating microelectronic devices such as those used in hand-held calculators.

Few scientists wishing to exploit this new technique will have the background to design the proper system for their particular application. This book by Wilson and Brewer is therefore timely. It contains all the principles and design criteria required for making an enlightened choice in buying or designing an implantation facility.

This book also complements the existing literature on ion implantation. The earliest book in the field, *Ion Implantation in Semiconductors* by J. W. Mayer, L. Eriksson, and J. A. Davies (Academic Press, 1970), emphasized the physics of the implantation process, ion channeling, and lattice location experiments by ion scattering, concentrating, as the title implies, on semiconductor aspects. A more recent book, *Ion Implantation* by G. Dearnaley, J. H. Freeman, R. S. Nelson, and J. Stephen (North-Holland, 1973), is more comprehensive, treating the physics of ion-solid interactions, radiation damage, the production and manipulation of ion beams, and applications of ion implantation to semiconductors and in other fields. These two books provide an excellent overall view of ion implantation, but lack the extensive coverage of the ion implantation system itself that is provided by *Ion Beams*. Although the book by Dearnaley *et al.* has an excellent section devoted to ion beam systems, it is not as complete as the present book, and a researcher interested only in the experimental aspects of ion implantation is apt to think twice before paying $79 for it.

*Ion Beams* covers systems design and the principles of operation of the component parts, from ion sources to sample chambers, and gives examples of practical applications to ion sputtering and to ion implantation. The chapter on ion sources presents the physical principles necessary for understanding the operation and relative merits of a wide variety of sources. The coverage is complete enough to orient the uninitiated reader, and a categorized bibliography is supplied to guide the more advanced reader. A particularly good chapter covering the principles necessary for design and evaluation of beam extraction and transport systems is provided. The chapter presenting total ion implantation systems design considerations will be particularly helpful to the researchers trying to select a commercial system. The chapter discussing specific applications and some of the attendant problems (such as radiation damage and channeling effects) is weak.

The merit of *Ion Beams* is not that it presents new information or better coverage of any of these topics than exists elsewhere but that it brings together the points that are relevant to ion implantation. Many helpful appendices are included (graphs of calculated projected ion ranges in a variety of solids and tables, charts, and guidelines for choosing the proper type of ion source and ionizable material to get the element desired from the source). Reading the book is a little like sharing an author's lab notebook, the effect being enhanced by some printing mistakes and other errors in need of correction.

I can recommend *Ion Beams* to the scientist who knows what research utilizing ion beams he wishes to do but doesn't know enough about the "black box" that injects energetic ions into his scattering chamber. As any scientist who has had to use positive ion accelerators in his research can attest, an intimate knowledge of accelerator physics and ion-solid interactions is painfully inseparable from the primary research objective. Accelerators operate in a continual state of collapse, ion sources deteriorate, extraction electrodes sputter away, insulators corrode and become conductors, accelerator tubes suffer radiation damage, power supplies fail, and so on. *Ion Beams* can head off some of these problems and should help solve others after the fact. It will not be the only reference required, because it does not, for example, cover ion-solid interactions or the physics of the ion implantation process thoroughly, but it will be helpful for any small-accelerator user.

B. R. APPLETON
*Solid State Division,*
*Oak Ridge National Laboratory,*
*Oak Ridge, Tennessee*

## Introducing the Solid State

**Inorganic Solids.** An Introduction to Concepts in Solid-State Structural Chemistry. D. M. ADAMS. Wiley, New York, 1974. xvi, 336 pp., illus. $22.50.

It is true, as those relatively few chemists who are interested in the solid state often charge, that typical chemistry curricula give too little attention to the subject. Chemists prefer gases and solutions where reactions and properties of individual molecules are conveniently studied. The solid state tends to interest them only insofar as x-ray crystallography is a uniquely powerful and invaluable means of determining molecular structure.

This book is written by a man who believes that "a good case can be made for structuring a majority of the inorganic syllabus around a core of solid-state theory." There, I think, he overstates his case, almost ludicrously. However, some corrective to the present neglect of the solid state in the teaching of chemistry does seem desirable, and this book could be a useful instrument to effect such change.

The book is important because it gives a comprehensive overview of the solid state as perceived by a chemist, specifically an inorganic chemist concerned with structure, bonding, and physical properties. It is written in a lively and pleasant style, and the author's own zest for his material comes through in a stimulating way. I should think students would be "turned on" by it. The treatment is intended to be, and largely succeeds in being, complete, logical, critical, and up to date, at a level suitable for juniors, seniors, or first-year graduate students in chemistry. I know of no other book that sets itself this particular

task. I think that this one could form the basis for an excellent and valuable course for senior chemistry majors.

The weaknesses of the book include some that are inherent to the attempt to present essentially mathematical concepts, such as band theory and Brillouin zones, in a purely qualitative way. I found the discussion of the Born-Haber cycle very turgid, and the implied definition (p. 97) of London forces is erroneous. There are also some verbal and typographical errors that could be confusing to the uninitiated. I cannot resist noting the misquotation of Tom Lehrer: the word is evade (which rhymes), not escape (which doesn't).

The strengths of the book, aside from its excellent overall design, are many. The discussion of ionic radii and their role in predicting structures is admirably critical. The presentations of the work of Mooser and Pearson, Phillips and van Vechten, and Kitaigorodski are excellent. I am not aware of any other book that tries to cover this ground. In my opinion, it succeeds well and fills a real need.

F. A. COTTON
*Department of Chemistry,*
*Texas A & M University,*
*College Station*

## Caste in Social Insects

**Sozialpolymorphismus bei Insekten.** Probleme der Kastenbildung im Tierreich. GERHARD H. SCHMIDT, Ed. Wissenschaftliche Verlagsgesellschaft, Stuttgart, 1974. xxiv, 974 pp., illus. DM 290. Bücher der Zeitschrift *Naturwissenschaftliche Rundschau.*

Caste is one of the defining qualities of insect societies. The higher social insects—the ants, termites, and eusocial bees and wasps—are all characterized by the division of colony members into reproductive queens and nonreproducing workers. In species with larger colonies, workers are further differentiated into subcastes, which consist either of stages in the life cycle through which individuals pass or fixed physical forms such as minor workers, medias, and soldiers. Insect castes constitute the most advanced such systems based on mobile individuals known in the animal kingdom; their degree of specialization approaches but does not equal that displayed by the sessile heterozooids of corals, ectoprocts, and other colonial invertebrates. Because the members of each colony are genetically diverse, the properties of the caste systems form a potentially important testing ground of kin selection theory.

*Sozialpolymorphismus bei Insekten*, a large and handsome volume edited by Gerhard H. Schmidt, documents the rich diversity of insect castes. It covers the literature with reasonable thoroughness up to the year 1972 and should serve as the definitive reference work for scholars interested in this subject. All groups of higher social insects are covered; there are also good reviews of aphids and locusts, which possess remarkable phases that are concerned less with social organization than with individual adaptations to changes in the environment. The emphasis of the book as a whole accurately reflects the state of the art. There are detailed, often highly technical accounts of the anatomical differences among castes and the genetic and physiological bases of caste determination, with much less attention being paid to behavior, especially communication among castes, and to demography and other aspects of population biology. Almost no mention is made of the ecological significance and optimization of caste ratios. These subjects seem clearly to offer the best opportunities for future research. *Sozialpolymorphismus bei Insekten* must be classified as an advanced treatise. It is not written or organized in such a way as to constitute a self-contained introduction, and its entirely German text will make it less than convenient for most English-speaking readers.

A strong feature of the book is its truly cosmopolitan authorship: the 26 contributors represent ten countries and many specialties, including biochemistry, cell biology, genetics, taxonomy, and morphology. No single theme or grand new conception emerges, but some chapters are particularly valuable. These include an explanation of kin selection and its special applications by W. D. Hamilton; an exhaustive review by G. H. Schmidt of *Formica polyctena*, the caste system of which is now the best studied of any insect species; and meticulous, richly illustrated accounts of the leptothoracine and social parasitic ants by Alfred Buschinger. Shôichi Sakagami traces the beginnings of caste differentiation among the species of the primitively eusocial halictine bees. Peter-Frank Röseler shows that caste interaction and worker control in bumblebees is more sophisticated than the otherwise relatively primitive behavior of these insects led us to suspect, while Heinz Rembold summarizes the lengthy biochemical studies which are at last beginning to isolate the queen-determining substances in royal jelly.

The weakest feature of the book is its astonishingly high price, which will probably limit its purchase to a small number of libraries and specialists. There have been too many such cases of overpricing in the last several years. Publishers left to their own devices tend to be very conservative in producing technical treatises. They print the smallest number they are confident of selling, then set the price high to guarantee against a fiscal loss. The projection becomes self-fulfilling, since the high price results in the expected small number of sales. Authors and editors would be well advised to bargain with publishers for a reasonable price, a large enough printing, and an adequate sales program to make a balanced account more probable. To obtain really good books publishers will be willing to gamble.

EDWARD O. WILSON
*Museum of Comparative Zoology*
*Laboratories, Harvard University,*
*Cambridge, Massachusetts*

## Books Received

**Advances in Comparative Physiology and Biochemistry.** Vol. 6. O. Lowenstein, Ed. Academic Press, New York, 1975. x, 262 pp., illus. $22.50.

**Advances in Pharmacology and Chemotherapy.** Vol. 12. Silvio Garattini, A. Goldin, F. Hawking, and I. J. Kopin, Eds. Academic Press, New York, 1975. xii, 408 pp., illus. $39.50.

**Albert Einstein in Bern.** Das Ringen um ein neues Weltbild. Eine dokumentarische Darstellung über den Aufstieg eines Genies. Max Flückiger. Haupt, Bern, 1974. 220 pp., illus. DM 38.

**Antibiotics.** Vol. 3, Mechanism of Action of Antimicrobial and Antitumor Agents. John W. Corcoran, Fred E. Hahn, J. F. Snell, and K. L. Arora, Eds. Springer-Verlag, New York, 1975. xii, 744 pp., illus. $77.10.

**Behavioral Pharmacology.** Susan D. Iversen and Leslie L. Iversen. Oxford University Press, New York, 1975. xiv, 310 pp., illus. Cloth, $10.95; paper, $5.95.

**The Biogenesis of Mitochondria.** Transcriptional, Translational and Genetic Aspects. Proceedings of a conference, Bari, Italy, June 1973. A. M. Kroon and C. Saccone, Eds. Academic Press, New York, 1974. xxii, 552 pp., illus. $19.

**Biological Interfaces.** An introduction to the Surface and Colloid Science of Biochemical and Biological Systems. Malcolm N. Jones. Elsevier, New York, 1975. x, 240 pp., illus. $24.50.

**Black Holes, Gravitational Waves and Cosmology.** An Introduction to Current Research. Martin Rees, Remo Ruffini, and John Archibald Wheeler. Gordon and Breach, New York, 1974. xvi, 332 pp., illus. + appendix. $29.50. Topics in Astrophysics and Space Physics, vol. 10.

**Cancer Epidemiology and Prevention.** Current Concepts. David Schottenfeld, Ed. Thomas, Springfield, Ill., 1975. xii, 574 pp., illus. $45.50. American Lecture Series Publication No. 953.

**Clinical Applications of Zinc Metabolism.** Proceedings of a symposium, Cleveland, Oct. 1971. Walter J. Pories, William H. Strain, Jeng M. Hsu, and Raymond L. Woosley, Eds. Thomas, Springfield, Ill., 1975. xvi, 302 pp., illus. $28.50.

**Concepts, Problems and Solutions in General Physics.** A Study Guide for Students of Engineering and Science. Vol. 1. Raymond A. Ser-

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