Book Reviews

Works intended for notice in this column should be sent direct to the Book-Review Editor (J. H. Robertson, School of Chemistry, University of Leeds, Leeds LS2 9JT, England). As far as practicable books will be reviewed in a country different from that of publication.

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Physics of modern materials. Vols. 1 and 2. Edited by M. LEWIS. Pp. Vol. 1, vi + 530; Vol. 2, vi + 690. Published by the International Atomic Energy Agency, Vienna, 1980. Price: Vol. 1, Sch. 760; Vol. 2, Sch. 980.

This book consists of a collection of papers compiled from the lectures presented at an international course at Trieste 29 March–24 June 1978, organized by the International Centre for Theoretical Physics, an establishment of the International Atomic Energy Agency (IAEA) together with papers representing lectures presented at a Symposium on Classical Fluids which was held as part of the spring college on 12 and 13 June 1978. The material has been edited by the editorial staff of the IAEA and is published in two volumes.

The papers pertaining to the spring college on Physics of Modern Materials have been grouped subjectwise into six parts. Papers belonging to the first three parts, *viz* (1) Characterization and growth, (2) Defects and (3) Mechanical properties comprise the contents of Volume 1 while papers belonging to the next three parts, *viz* (4) Metals and aloys, (5) Semiconductors and devices, and (6) Amorphous materials and superionics, together with papers pertaining to the symposium on classical fluids, comprise the contents of Volume 2.

On the whole it represents a well organized review of the recent advances in the state of the art and the insights provided by theoretical developments in the study of the physics of modern materials along its various nascent and promising facets. The book (both volumes) is well presented. The sketches, diagrams, and graphical illustrations are well set out, thoroughly marked and explained; the photographs are well reproduced; and most of the papers give extensive references to recent articles on the topics dealt with. Typographical errors are very few, to the credit of the editorial staff.

Most of the articles are well written with a lucid style and research workers, teachers, and technical persons interested in the field will undoubtedly benefit in having access to the book. Most of the articles give extensive bibliography for use by enthusiastic workers in the related fields. But what many will miss is a subject index for ready reference and the absence of one will much minimize the work's role as a reference book. The books by their very nature will not be suitable as text books but will certainly be used extensively by research workers and teachers interested in the different fields of materials science.

Now coming to a discussion of the different parts we find that part 5 (semiconductors) is perhaps the best organized, containing a collection of five excellent articles together with a classified bibliography for energy bands in semiconductors. Particular mention should be made of the article on *Semiconducting devices* by A. Frova, which is very well illustrated and of the highly interesting extensive article on *Optoelectronic materials and devices* by A. T. Schmidt, in which the author develops the theory from the fundamentals, and leads us to *Nonlinear optics, lasers, optical switching and guided wave devices.*

Many research workers in experimental and theoretical fields, teachers and also graduate students will find interesting the excellent and extensive article by C. Paorici in part 1 in which the author has dealt at length with the various aspects of crystal growth and doping (both experimental and theoretical). The article is well illustrated.

The masterly article on *Defects* by J. Friedel in part 2 containing an illuminating introduction will be very helpful to its readers in developing physical concepts and insight. The article is quite extensive and includes discussion of friction and of liquid crystals, and is well illustrated.

Mention must also be made of the article by B. T. Matthias & P. R. Stein on *Superconducting materials* in part 4. The article, though descriptive and empirical, is highly penetrating and lucid as coming from a master mind.

But part 3 comprising papers dealing with mechanical properties, a most vital and interesting field, appeared to this reviewer to have been rather ill organized. The first paper by D. McLean on *Fracture mechanics* (a highly important, rapidly developing topic) has a very unsatisfactory bibliography which cites no research paper and only a few books, mostly published before 1974. The other two papers are highly abstruse mathematical articles.

Some will find themselves interested in the article by W. E. Spear in part 6 in which the author deals with the properties and promises of amorphous Si. The papers presented at the Symposium on Fluids are mainly highly mathematical.

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Surface crystallography by LEED: theory, computation and structural results. By M. R. VAN HOVE and S. Y. TONG. Pp. ix + 286. **Springer Verlag series in chemical physics,** edited by R. GOMER. Berlin: Springer Verlag, 1979. Price DM 59.00, US $32.50.

In the preface, the authors point out that their aim is to publish a set of programs for use in the analysis of LEED data and for the description of surfaces. They also state that

there is an obvious relationship between surface band structure and LEED calculations and hence that the programs provided could be used for either. The methods used are based on a dynamical formulation of the scattering problem and use approaches due to J. B. Pendry.

The set of programs provided comprise almost 200 of the 278 pages of the volume. They are most complete and an offer is made to send a magnetic-tape copy of these programs to interested parties. In fact, one of the members of our laboratory (Dr A. Smith) has made use of this offer and has used such a tape. This experience has shown that the programs work quite well to the extent that the authors claim although, as stated in the book, since there are so many different types of problems, exhaustive tests of the programs have not been carried out.

The book cannot be used without reference to the work of J. B. Pendry, *Low energy electron diffraction* (Academic Press, 1974). This is acknowledged by Van Hove and Tong. Pendry's book contained a set of programs that could deal with simple substances. In the volume under review a significant new method has been introduced, the 'combined space method', which, together with further developments, allows a much wider range of real crystals to be dealt with. It is a pity that the detailed formulation of symmetry lacks contact with the treatments of symmetry in dynamic diffraction that have occurred in other areas of diffraction and crystallography such as electron diffraction and X-ray diffraction. It is clear from reported work in the literature, as well as the many results displayed in this volume, that surface structure analysis, using the methods described in this text, is now a common activity. In addition to the coordinates of atoms at real surfaces, the thermal vibration amplitudes of these atoms are also being estimated. At present this is done at the level of a simple Debye–Waller factor.

This book is an invaluable tool for those research groups which are involved in the study of atomic and electronic surface structure. There is a useful summary of results in these areas which is reasonably complete to the year 1978. The book is not truly a book in the traditional sense but rather a brief review of LEED theory combined with a detailed instruction manual for the use of a set of computer programs for the calculation of LEED intensities and some other surface properties.

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Superionic solids: principles and applications. By S. CHANDRA. Pp. xi + 404. Amsterdam: North Holland, 1981. Price US $78.00, Dfl 160.00.

Although the field of superionic conductors, preferably referred to as solid electrolytes or fast ion conductors, has attracted an intense research effort over the last decade or so, a good teaching text was hitherto unavailable. Chandra's book represents, in the first place, a welcome effort to take the reader with little knowledge of solids through a descriptive and well illustrated course to a well rounded understanding of this area. Even for the specialist, the description extends to include comprehensive compilations of up to date data digested in a very satisfying fashion.

In the second place, the chapters on *Experimental probes* and *Applications* provide a uniquely wide-ranging coverage ideal for those entering the field or diversifying their interests within the field.

Finally, there are two chapters which more formally and extensively develop the theoretical description of *Ion transport in point defect type ionic and superionic solids* and *Ion transport in molten sublattice type superionic solids.*

The book will be valued by teachers, students and research workers alike for its unified yet detailed approach which only a single author could bring to a work such as this.

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Crystal cohesion and conformational energies. Part 26 of **Topics in current physics.** Edited by R. M. METZGER. Pp. ix + 154. Berlin–Heidelberg–New York: Springer Verlag, 1981. Price DM 54.00, US $23.00.

This book contains four chapters devoted to the calculation of cohesive energies in organic crystals and dimers and of energies in larger biomolecules.

In the first chapter D. E. Williams reviews his approach to the calculation of lattice energies of organic crystals by means of the empirical atom–atom potential method, using transferable parameters. He discusses various types of interaction-energy contributions and amply describes methods for the derivation of the parameters and point charges needed for the potentials. Detailed results are shown and discussed for 18 hydrocarbon crystals. Special attention is paid to the tedious formulation of the analytical expressions for the matrix elements used in the least-squares formalism for the refinements of the parameters.

F. A. Momany shows in the second article how conformational analysis can aid in polypeptide drug design. After a brief introduction of the method used for the calculation of the conformational energy of a polypeptide (*viz* using empirical potentials and the computer program *ECEPP*) he illustrates it with a number of examples. These include peptide backbones and modifications of these [*e.g.* *N*-methyl analogs, depsipeptides, carbazic acid (α-aza) analogs], aspects of bond types, chain reversal and direction reversal, disulfide bonds and modification of side chains (*e.g.* α,β dehydro analogs). For these examples a number of isoenergetic contour diagrams is given, from which favorable conformations can be deduced. The author also discusses