range order are exemplified by EXAFS or IR and Raman vibrational spectroscopy. The preparation of semiconducting materials, and doping by glow discharge, sputtering and ion implantation are reviewed; also, electronic transport properties of the doped materials are considered. Finally, reference is made to the properties of doped and undoped amorphous silicon containing hydrogen bonds, as rendering such materials attractive for use in solar cells.

M. INOUE

Semiconductor R & D Center
Matsushita Electronics Corporation
Nagaokakyo
Kyoto
Japan

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Ferroelectric semiconductors. By V. M. FRIDKIN. (Translated from Russian.) Pp. xiii + 318. New York: Consultants Bureau, 1980. Price US $69.50.

In eight very condensed chapters, V. M. Fridkin presents an extensive and detailed picture of phenomena and theories related to ferroelectric semiconductors. As pointed out in the preface of the book, the special modification of semiconductor properties by some ferroelectric characteristics make these materials not very favorable objects for the study of elementary processes in semiconductors. However, when the effect of electrons on the fundamental thermodynamic functions and the conduct of these electrons near the Curie temperature were investigated, a series of new phenomena was discovered. They originate in the high concentration of carriers in ferroelectric semiconductors, on the ground of which the contribution of the electron subsystem free energy to the lattice free energy becomes noticeable at the Curie point. The effect of photoactive illumination produced by nonequilibrium carriers on Curie temperature and spontaneous polarization leads to phenomena which have already found practical applications in holography and optical memory systems. In addition, Fridkin stresses the point that photoelectric phenomena in ferroelectrics will play an important role in the further development of electrooptics and nonlinear optics.

It should be added here that the original Russian text was published by Nauka Press in 1974 and that, except for minor corrections and comments, no changes appear in the English edition.

As to the basic idea behind the book, Fridkin emphasizes that he intended to give a description, as complete and systematic as possible, of phenomena and interpretation of electric processes in ferroelectrics, but not a description of the typical ferroelectric semiconductor materials.

In the first three chapters, a very detailed mathematical treatment (more than 300 equations) of the thermodynamic and microscopic theory of ferroelectric semiconductors is given, including, among other topics, phase transitions, the ferroelectric mode of vibration, screening of spontaneous polarization, forbidden band width, photoferroelectric phenomena.

The fourth chapter discusses the temperature dependence of the width of the forbidden band (Eg) near first- and second-order phase transitions for a very large number of ferroelectrics, from Rochelle salt to trihydrogen and trideuterium selenides and to singular ferroelectrics like $Gd_2(MoO_4)_3$ and trimetal boracites, *e.g.* $Fe_3B_7O_{13}Cl$. It then gives, and discusses, experimental data about the intrinsic optical absorption edge of ferroelectrics with $Eg \geq 3$ eV (single crystal $BaTiO_3$ as an example) and high-resistance semiconductors with $Eg \simeq 2$ eV ($A^{V}B^{VI}C^{VII}$ and $A^{V}_{2}B^{VII}_{3}$ crystals as representatives). After analyzing the shift of the absorption edge at the Curie point produced by an electric field, the chapter closes with reports from several investigators about calculation of the band structure of perovskite, $A^{V}B^{VI}C^{VII}$ and $A^{V}_{2}B^{VII}_{3}$ ferroelectric compounds.

Photoferroelectric phenomena (starting with the thermodynamics of these phenomena) and photostimulated phase transitions are the content of the fifth chapter. Also given is the thermodynamic treatment of photostimulated phase transition in nonferroelectric materials. Examples of those phenomena include – among others – photosensitive phase transitions in ferromagnetic semiconductors and photocrystallization of selenium and hydrocarbons. Photocondensation of the vapors of water (Tyndall) and other liquids, which had previously been explained as photochemical reactions, are now known to be caused by the increase of the energy of the intermolecular interaction with electron excitation of the molecules.

Introducing chapter 6, entitled *Screening phenomena*, Fridkin stresses the fact that the screening of the spontaneous polarization by equilibrium and nonequilibrium carriers determines the basic ferroelectric and semiconductor properties and that a number of photoferroelectric phenomena are produced by the screening action of the latter. Various methods for the observation of screening effects are described and a number of examples are recorded and shown by microphotographs.

The report about screening phenomena is continued in the following chapter where the formation of photoelectrics is theoretically and empirically discussed. A number of graphs illustrate the dependence of photoelectric and pyroelectric charge density of $BaTiO_3$, SbSI and $SbSI_{0.35}Br_{0.65}$ on several independent variables. The inverse effect on the polarization of some of these compounds produced by the internal field of the photoelectric is evidenced by various graphs. Finally, the effect of radiation on ferroelectric polarization reversal is distinctively proved by several series of hysteresis-loop photographs.

The book closes with a chapter about *Ferroelectrics as nonlinear semiconductors*. Here, Fridkin points out that much of the work which has been done on relevant problems is quoted in the detailed monograph of E. V. Bursian: *Nonlinear crystals. Barium titanate*, Nauka (1974). Therefore, Fridkin discusses in the chapter only some relatively new phenomena to the investigation of which he and his co-workers have made a definite contribution.

There is no doubt about the great value of this book written by a distinguished expert. Profound theoretical knowledge and extensive familiarity with current problems, solved and unsolved, are combined in the book and make it a very useful source of information in its special field.

The very condensed presentation of the content was probably necessary in order to accommodate the great amount of detailed information. However, it makes the study difficult in some sections especially when new magnitudes or equations are introduced or results quoted without sufficient

explanation. This might be one of the reasons why the book will probably not become a student textbook. But it certainly will serve as a special reference book not only for experts in ferroelectrics but also for graduate students under some guidance.

Terms used for some of the ferroelectric compounds are unfamiliar in English terminology or even wrong; *e.g.* the term 'lead *and zirconium* titanate' might perhaps be used in the Russian translation for $Pb(ZrTi)O_3$, but the compound $SbNbO_4$ cannot be called a ferroelectric *perovskite*.

More than two thirds of the 359 references were published in Russian journals. According to Fridkin, the ferroelectric properties of Rochelle salt were discovered by Kurchatov. In fact, Kurchatov's papers were published in 1930 in German and Russian journals, whereas Volasek's reports appeared in 1921, 1922, 1924 in *Phys. Rev.*

The book is well presented. The diagrams are well set out, thoroughly marked and explained; the photographs are carefully selected and well reproduced.

K. M. CASTELLIZ

Atlantic Industrial Research Institute
Technical University of Nova Scotia
Halifax
Nova Scotia
Canada B3J 2X4

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The physics and chemistry of liquid crystal devices. Edited by G. J. SPROKEL. New York, London: Plenum Press, 1980. Price US$42·50.

The possibility of using liquid crystals for displays was recognized just over ten years ago. Today the world production of LCDs (liquid crystal displays) is probably around fifty million per annum. This phenomenal growth may be traced to the fact that there was a need for a compact, low-power display and the LCD, which consumes only of the order of a $\mu W\ cm^{-2}$ of active display area, fulfilled that need. At present the demand is almost entirely for digital displays for watches, pocket calculators and portable electronic instruments, but already other formats, analogue displays and relatively simple matrix displays, are beginning to appear on the market and the future looks very promising indeed. However, in point of fact, is this remarkable trend likely to continue in the 80s?

As it turns out, many problems still remain to be understood and solved in order to improve the LCDs now being manufactured and to develop larger and more sophisticated displays. For example, what is the nature of the interaction between the liquid crystal and the substrate and what is its precise role in determining the surface anchoring properties? What are the relevant material and device parameters and how can they be modified to improve the performance? What are the limits of multiplexed addressing? What are the prospects for high information content LCDs, colour television screens, *etc.* – do we have to have a fresh breakthrough in technology and manufacture?

These are some of the many questions that have been considered in this book, a collection of papers presented at a symposium held at the IBM Research Laboratory, San Jose, California, on February 7 and 8, 1979. The authors are for the most part from well known laboratories that have been actively concerned with the practical applications of liquid crystals – IBM, Bell Laboratories, Hewlett–Packard, Beckman, Tektronix, Texas Instruments, Hitachi, RSRE, Brown Boveri, Philips, *etc.* The contributions have been grouped under three broad headings, *Physics* (12 papers), *Devices* (6) and *Materials* (6), though, not surprisingly, there is considerable overlap in many cases. By and large the papers are of high standard and serve to focus attention on the variety of fascinating problems one has to come to grips with to make further progress in this field. The book is well produced and should be appreciated by anyone interested in this rapidly developing area of technology.

S. CHANDRASEKHAR

Raman Research Institute
Bangalore—560 080
India

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Books Received

The following books have been received by the Editor. Brief and generally uncritical notices are given of works of marginal crystallographic interest; occasionally a book of fundamental interest is included under this heading because of difficulty in finding a suitable reviewer without great delay.

Synchrotron radiation research. Edited by H. WINICK and S. DONIACH. Pp. xx + 754. Plenum, 1980. Price US$ 65.00. "The explosive growth of interest in this extraordinary tool constitutes a major event in the recent history of scientific instrumentation." With this observation, this book begins, and its size and weight well justify the remark. It is hardly a year ago that we commented [*Acta Cryst.* (1980), A**36**, 333] on another overview of synchrotron radiation, edited by Kunz. The present book is not any more up to data than Kunz (which consisted essentially of conference papers) but is a fuller and more coherent text. There is a 40-page chapter devoted to single-crystal diffraction, with over 60 references to original literature, and there are separate chapters on small-angle scattering, on EXAFS, and on topography, as well as many chapters on non-crystallographic matters.

Quasi-particles: ideas and principles of solid state physics. By M. I. KAGANOV and I. M. LIFSHITS. Pp. 96. Mir publishers, Moscow, London, 1980. Price 75p.

Physics in high magnetic fields. Edited by S. CHIKAZUMI and N. MIURA. Pp. x + 358. Springer-Verlag, 1981. Price DM 74.00, US$43.70. This volume represents the proceedings of the international seminar held in Japan, in September 1980; it describes recent developments in semiconductor physics and high magnetic fields, both continuous and pulsed.

Ultrasoft X-ray microscopy: its application to biological and physical sciences. Edited by D. F. PARSONS. Pp. v + 402. New York Academy of Sciences, 1980. Price $70.00. This book collects the papers presented at the conference, with this title, held in June 1979.