methods. There seems to be a rule in crystallography that every new idea for attacking the phase problem works well the first time and much less well after that. The obvious explanation that methods which fail at the first try are immediately abandoned and never reported is, unfortunately, inadequate; as would appear from careful questioning of some of the people concerned. It would be interesting to know the true explanation of this well-established phenomenon.

Thermoelectric Materials and Devices. Lectures (New York U., June 1959, 1960). Edited by Irving B. Cadoff and Edward Miller. 344 pp. Reinhold Publishing Corp., New York, 1960. $9.75.

Thermoelectricity. Including the Proc. of NRL-spons'd Conf. (Sept. 1958). Edited by Paul H. Egli. 407 pp. John Wiley & Sons, Inc., New York, 1960. $10.00. *Reviewed by Peter L. Balise, University of Washington.*

SCIENTISTS and engineers have recently become excited about thermoelectricity: the former because of the relevant problems awaiting solution in solid-state physics and thermodynamics, the latter because of the challenge to develop useful equipment for refrigeration and power generation. Perhaps no other field today offers greater opportunities in materials science for the understanding and creation of substances with specific properties. The public has read much about the marvelous thermoelectric devices that are around the corner, but economically feasible appliances are further away than the lay press implies.

Even technical books such as the two reviewed here tend to minimize the limitations of present materials. The basic criterion for performance of a thermoelectric device is the "figure of merit", which is improved by large Seebeck coefficients, and by low thermal conductivity and high electrical conductivity. The latter two requirements are obviously difficult to optimize coincidentally, and this is a practical reason for seeking understanding of the physics of materials. In addition, other properties are important in achieving good temperature range, life, and ease of fabrication.

The problems are being vigorously attacked, as attested by the papers on the subject; both these books are compilations of such papers. *Thermoelectric Materials and Devices* is a series of lectures given at New York University, dealing about equally with theory, materials, and devices. Basic principles are presented, and equations are derived for thermoelectric behavior of materials (including thermionic emission) and for performance-criteria of circuits. A considerable amount of data is given for many materials, refractories, and liquids (fused salts), as well as the more common compounds such as tellurides. Design calculations are given in detail, including nomographs and tables. A chapter is devoted to nuclear heat conversion. Experimental models of devices such as a refrigerator and an air conditioner are described.

Thermoelectricity is divided into four sections. The first considers fundamental concepts, with practical considerations for equipment, including generators in space vehicles. The second and third sections discuss the physics of materials and problems of application to high-temperature devices, including thermionic power conversion. The last section is devoted to measurement of material properties, particularly thermal conductivity, with emphasis on methods of meeting the difficulties imposed by high temperatures.

While both books are written at a high technical level and have similar coverage, *Thermoelectric Materials and Devices* seems somewhat better organized, with more data on specific materials. *Thermoelectricity* has a more attractive format and better information on measurement techniques. This reviewer suggests *Thermoelectricity* for the purchaser of only one book, but both would be wanted by anyone with a serious interest in the field.

Surface Microtopography. By S. Tolansky. 296 pp. Interscience Publishers, Inc., New York, 1960. $9.00. *Reviewed by J. Arol Simpson, National Bureau of Standards.*

AS physics experiments become more and more complex, more and more time is spent attempting to master techniques, inevitably tricky, which are, or at least should be, ancillary. It is always then a satisfaction to find that somewhere in the world there is someone who has made one of these techniques a life's work, and a joy if he has seen fit to describe his work in detail.

Just such a happy event has occurred in the appearance of this book. Professor Tolansky, who almost twenty years ago developed the technique of multiple-beam interferometry for the measurement of surface microtopography, has spent the intervening time refining the procedures until it is now possible to measure step heights of 20 A or less. In this book he tells *how to do it* and by means of over 350 interferograms taken in the process of his studies of such problems of the topography of diamond faces, the oscillation of quartz crystals, indentation-hardness testing of metals, and the wear of glazier's diamonds, shows eloquently the power of the method.

The book is a model of what a *how to do* book should be, for despite the author's interest in, and great knowledge of, the objects studied, he concentrates on the way the measurement was made rather than the result. Moreover, he describes some good ideas that did not work, modulated fringes, for example, and explains, as far as is known, why they did not. For those who are interested in the results the book is provided with a complete bibliography of the papers of the author and his co-workers including the degree thesis from his laboratory. Moreover, when the going gets rough, as in making the high-reflectance coatings for the optical flats, he provides "cookbook" instructions, "helpful hints", and simple tests to smooth the way. I only wish all authors were as considerate.

All in all this is a highly specialized but excellent

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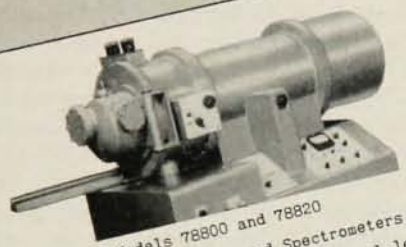

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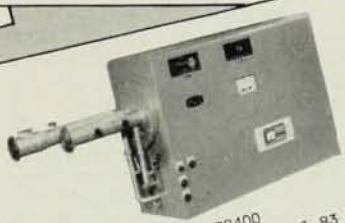

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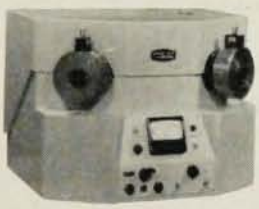

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book and should be in the library of anyone who has any interest in microtopography, thin films, or interferometry. After such praise it is ironic to note that the problem in thin-film measurement by multiple-beam interferometry currently plaguing the reviewer, the question of the accuracy of the reflecting-overlay contouring where the film and the substrate have widely different "sticking coefficients", is the only thing I could not find in the book!

Photoconductivity of Solids. By Richard H. Bube. 461 pp. John Wiley & Sons, Inc., New York, 1960. $14.75. *Reviewed by Stuart A. Rice, Institute for the Study of Metals, The University of Chicago.*

THE book under review offers an excellent survey of the current state of understanding of the mechanism of photoconductivity. The emphasis throughout is on a quasi-theoretical interpretation and systematization of the observations. By quasi-theoretical I mean that the analysis is couched in the language of band theory, impurity levels, hole conduction, effective mass, and so forth, but the fundamental approach is to tie these concepts together in a workable parametric scheme rather than to attempt any a priori studies of the possible electronic states and their perturbations by impurities. In view of the difficulty of making direct calculations of electronic properties, this approach is especially useful and valuable. The scope of the treatment is easily assessed from the list of chapter headings which include: Electronic Processes in Crystals (a brief but adequate survey of elementary band theory), Photoconductivity Processes (an analysis in the spirit of the mechanistic approach to chemical reaction kinetics), Preparation of Photoconductors (containing an excellent discussion of the advantages and disadvantages of various experimental methods), Electrode Effects, Imperfection Photoconductivity, Energy Bands and Excitation Transitions, Free Carrier Scattering and Mobility, Traps and Trapping Effects, Recombination Processes, Theoretical Viewpoints on Photoconductivity (where the analysis has the phenomenological bent described above), and Related Topics. The extensive bibliography includes 1009 references.

This book serves not only as an excellent introduction but also will find extensive use as a reference text. It can be wholeheartedly recommended to all those interested in the solid state.

Ionization Phenomena in Gases. Conf. Proc. (Uppsala, Aug. 1959). Edited by N. Robert Nilsson. Vol. 1, 554 pp. Vol. 2, 656 pp. North-Holland Publishing Co., Amsterdam, Netherlands, 1960. $34.50. *Reviewed by Nandor L. Balazs, Princeton University.*

THESE conference proceedings weigh nine pounds, four ounces and contain 227 articles. They are arranged in four parts with many sections to each one. (1) Fundamental Processes in Gas Discharges (collision processes, ionization in an electric field, radiation proc-