

tives Cracknell has divided his book almost equally between reprints and text with about 200 pages of each.

The first four chapters provide an orientation in the terminology and basic mathematics of group theory, and there are brief discussions of some important groups, including the crystallographic and full-rotation groups. The remaining four chapters touch on a large number of applications: normal modes of vibration of molecules and solids, crystal field theory, isobaric spin in classifying nuclear energy levels, and so forth. There are problems at the end of each chapter, with solutions at the end of the book.

In his preface the author points out that there is no textbook available that is both oriented towards physics students and yet "understandable by undergraduates." Cracknell's book, although it handles some topics with enviable lucidity, is not the book to fill this gap—the discussion is too superficial. The author does manage to show how valuable group theory can be, but he never discusses any topic sufficiently deeply for the reader to become master of it. Well, almost never: The one exception is the discussion of the normal modes of the methane molecule, which is relatively detailed and tied in with reprints of papers by Eugene Wigner and E. Bright Wilson Jr. The book would have been more valuable if other topics had also been treated in this depth. However, the book is unsuitable for self-study except as a quick survey. Not enough material is presented in the text for one to understand the terminology of some of the reprints without reference to other books.

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The reviewer is an associate professor at Stevens Institute of Technology.

Metals and insulators

SOLID STATE PHYSICS: ADVANCES IN RESEARCH AND APPLICATIONS, VOL. 21. Frederick Seitz, David Turnbull, Henry Ehrenreich, eds. 513 pp. Academic Press, New York, 1968. \$24.50

by DANIEL C. MATTIS

This latest volume in the "Seitzschrit" consists of four excellent reviews of related topics in the metal-insulator

problem. The opener is a review by David Adler of the known facts about transition-series oxides; the second article is a theoretical analysis of the hypothetical excitonic insulator by B. I. Halperin and T. M. Rice. The third review is a report by Joachim Appel on a decade of halting progress in the vexing polaron problem, and the fourth article is a compendium by Bernard R. Cooper of the magnetic properties of rare-earth metals. Competently written and edited, this volume recommends itself to a large category of solid-state physicists for study and reference.

* * *

The reviewer is professor of solid-state physics at the Belfer Graduate School of Science, Yeshiva University, where he occasionally works in semiconductor physics.

NEW BOOKS

CONFERENCE PROCEEDINGS

Physics of Solids in Intense Magnetic Fields. E. D. Haidemanikis, ed. (Chania, Crete, 16–29 July 1967) 606 pp. Plenum, New York, 1968. \$45.00

Mass Motions in Solar Flares and Related Phenomena, Nobel Symposium 9. (Capri, 10–12 June 1968). Yngve Ohman, ed. 245 pp. Wiley (Interscience), New York, 1969. \$22.00

Mechanical and Thermal Properties of Ceramics. (NBS-303) J. B. Wachtman Jr. ed. (Gaithersburg, Md., 1, 2 April 1968) 268 pp. National Bureau of Standards, Washington, DC, 1969. \$4.75

The Fourth International Vacuum Congress, Parts 1 and 2. (Manchester, 17–20 April 1968). Arranged by the Joint British Committee for Vacuum Science and Technology. 447 pp. and 827 pp. Institute of Physics and Physical Society, London, 1968. \$15.00 (part 1)

ELEMENTARY PARTICLES

Interaction Cross Sections of Elementary Particles. By V. S. Barashenkov. 416 pp. Daniel Davey, Hartford, Conn., 1969. \$21.50

NUCLEI

Nuclear Structure. By Aage Bohr and Ben R. Mottelson. 471 pp. W. A. Benjamin, New York, 1969. \$25.00

ATOMS, MOLECULES, CHEMICAL PHYSICS

Organic Electronic Spectral Data, Vol. 5. J. P. Philips, R. E. Lyle and R. Jones, eds. 1019 pp. Wiley (Interscience), New York, 1969. \$34.95

Electrochemistry for Technologists. By G. R. Palin. 225 pp. Pergamon, New York, 1969. Cloth \$5.50, paper \$4.00

Les Elements des Terres Rares. By Jean



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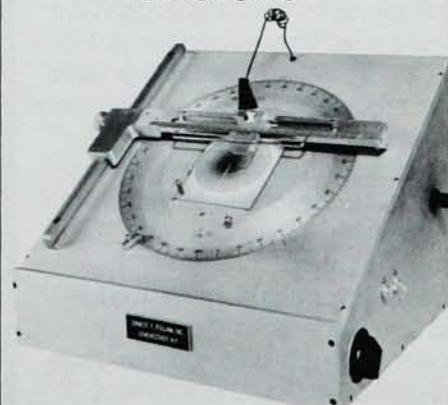


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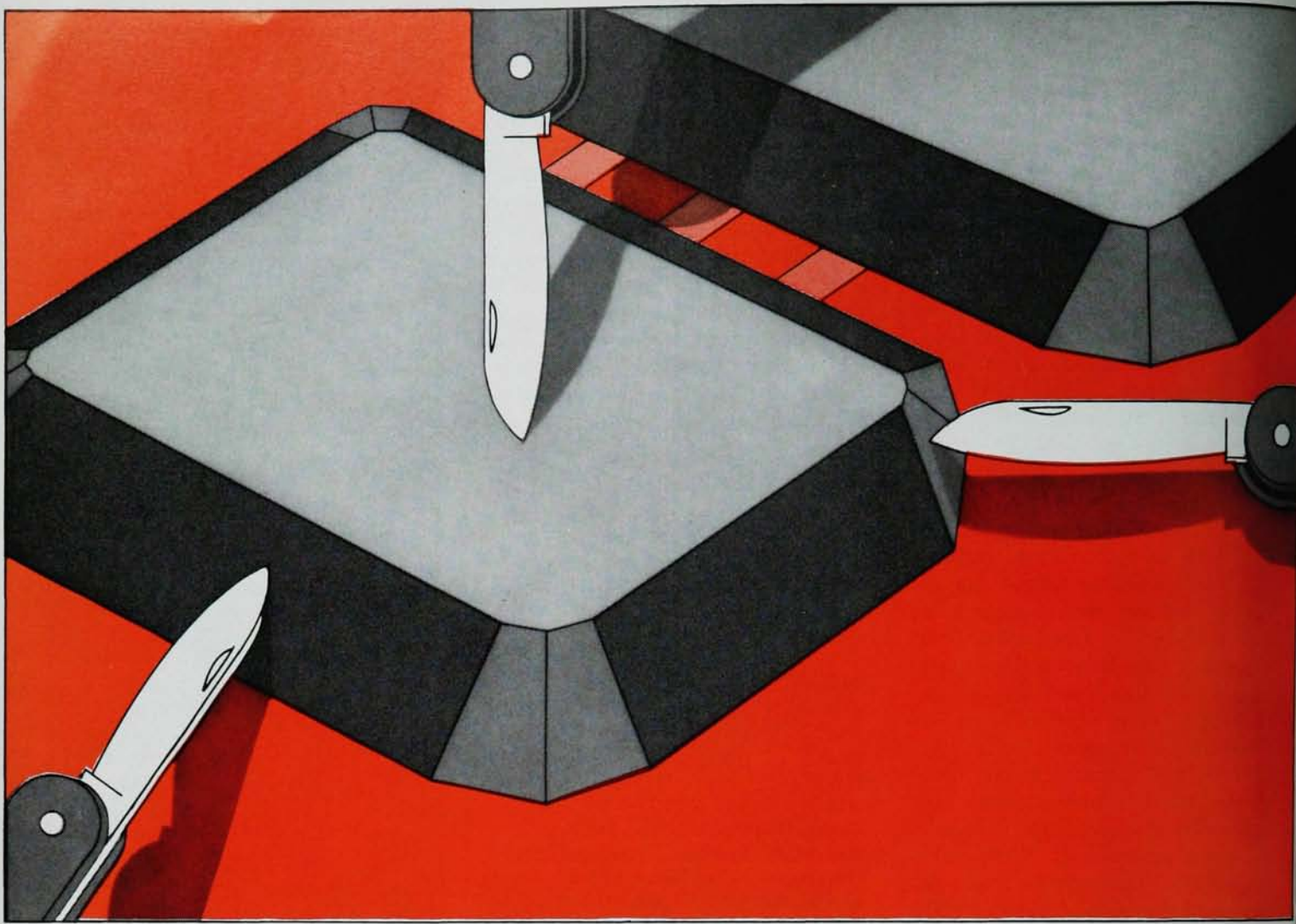


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The new technique makes wedge-shaped slots, separating the circuit elements along precise lines. It depends on a "preferential" etchant, which most strongly attacks the semiconductor perpendicular to a particular crystal-lattice plane. The slot is wedge-shaped

because its walls are other planes toward which the etchant is almost inert.

The process is self-limiting; once a slot goes through a wafer, there is very little further etching. So, we can leave the wafer in the etchant long enough for complete separation of the parts without the careful thickness control formerly required. And, because of the fixed slope of the slot walls, minimum slot width can be much less than wafer thickness.

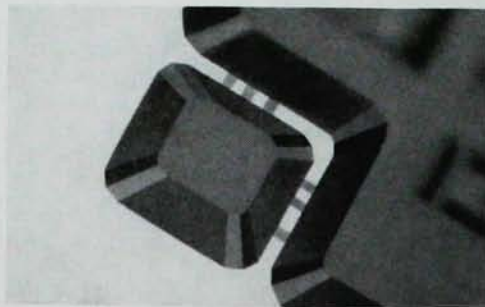
In the drawing, the light, medium, and dark surfaces represent three crystal-

lographic planes in silicon. The solution etches perpendicular to each of these at different rates. The surface shown light, for example, etches away most rapidly. To cut out an area, a mask is applied onto the fastest—"light"—plane, with the mask edges parallel to the slowest—"dark"—planes of the crystal.

In one example of the new technique, hundreds of 1-mm-square circuits, each with 10 transistors, 14 diodes, and 12 resistors on nine air-isolated areas, were etched at once on a single wafer. Slots were about 17 microns wide with strong "beam leads" for structural and electrical connections. The slot in the photo is only 6 microns wide.

This technique is another step toward making ever better and smaller integrated circuits.

From the Research and Development Unit of the Bell System—



Bell Labs

Flahaut. 165 pp. Masson et C^{ie}, Paris, 1969. 56F

Introductory Group Theory and Its Application to Molecular Structure. By John R. Ferraro and Joseph S. Ziomek. 240 pp. Plenum, New York, 1969. \$15.00

ACOUSTICS

The Acoustical Foundations of Music. By John Backus. 312 pp. W. W. Norton, New York, 1969. \$7.95

Linear Piezoelectric Plate Vibrations: Elements of the Linear Theory of Piezoelectricity and the Vibrations of Piezoelectric Plates. By H. F. Tiersten. 212 pp. Plenum, New York, 1969. \$15.00

MECHANICS

Mechanics. By Ray Skinner. 744 pp. Blaisdell, Waltham, Mass., 1969. \$14.50

Géométrie Différentielle et Mécanique Analytique. By Claude Godbillon. 183 pp. Hermann, Paris, 1969. 24F

OPTICS

An Introduction to Coherent Optics and Holography. (2nd edition) By George W. Stroke. 358 pp. Academic, New York, 1969. \$11.50

Principles of Holography. By Howard M. Smith. 239 pp. Wiley (Interscience), New York, 1969. \$9.95

ELECTRICITY AND MAGNETISM

Physics of Semiconductor Devices. By S. M. Sze. 812 pp. Wiley (Interscience), New York, 1969. \$19.95

Ionospheric Radio Waves. By Kenneth Davies. 460 pp. Blaisdell, Waltham, Mass., 1969. \$13.50

Quantum Theory of Magnetic Resonance Parameters. By Jasper D. Memory. 192 pp. McGraw-Hill, New York, 1968. \$9.95

Electron Optics. By Bohdan Paszkowski. 305 pp. American Elsevier, New York, 1969. \$13.00

FLUIDS

Fluid Mechanics for Engineers. (3rd edition) By P. S. Barna. 409 pp. Plenum, New York, 1969. \$11.50

SOLIDS

Defects and Radiation Damage in Metals. By M. W. Thompson. 384 pp. Cambridge Univ. Press, New York, 1969. \$18.50

Constitution of Binary Alloys. (2nd supplement) By Francis A. Shunk. 720 pp. McGraw-Hill, New York, 1969. \$37.50

Current Topics in Radiation Research, Vol. 5. Michael Ebert and Alma Howard, eds. 292 pp. Wiley (Interscience), New York, 1969. \$15.50

Tunneling Phenomena in Solids. Elias Burstein and S. Lundqvist, eds. 579 pp. Plenum, New York, 1969. \$35.00

Fracture: Vol. 5, Fracture Design of

Structures; Vol. 6, Fracture of Metals. Harold Liebowitz, ed. 525 pp. and 505 pp. Academic, New York, 1969. \$25.00 and \$26.00

Croissance de Composés Minéraux Monocristallins. J. P. Suchet, ed. 169 pp. Masson et C^{ie}, Paris, 1969. 55F

Liaisons Interatomiques et Propriétés Physiques des Composés Minéraux, Vol. 1. By J. P. Suchet. 270 pp. Centre de Documentation Universitaire, Paris, 1968.

Springer Tracts in Modern Physics, Vol. 48. G. Hohler, P. Falk-Vairant, S. Flügge, J. Hamilton, F. Hund, H. Lehmann, E. A. Niekisch and W. Paul, eds. 208 pp. Springer-Verlag, New York, 1969. \$12.00

ASTRONOMY, SPACE, GEOPHYSICS

Gravitation: An Elementary Explanation of the Principal Perturbations in the Solar System. By George Biddell Airy. 173 pp. NEO Press, Ann Arbor, Mich., 1969. Cloth \$5.00, paper \$2.50

BIOPHYSICS

Theoretical and Experimental Biophysics, Vol. 2. Arthur Cole, ed. 343 pp. Marcel Dekker, New York, 1969. \$17.75

Progress in Biophysics. By W. Fuller, C. Rashbass, L. Bragg and A. C. T. North. 150 pp. W. A. Benjamin, New York, 1969. Cloth \$10.00, paper \$3.95

THEORY AND MATHEMATICAL PHYSICS

Mathematical Methods in Solid State and Superfluid Theory. R. C. Clark and G. H. Derrick, eds. 400 pp. Plenum, New York, 1968. \$26.50

Elementary Quantum Mechanics. By Morten Scharff. 213 pp. Wiley (Interscience), New York, 1969. \$5.96

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Thin Film Technology. By Robert W. Berry, Peter M. Hall and Murray T. Harris. 706 pp. D. Van Nostrand, Princeton, N. J., 1968. \$15.00

The Manipulation of Air-Sensitive Compounds. By D. F. Shriver. 299 pp. McGraw-Hill, New York, 1969. \$17.50

Control Systems for Technicians. By G. T. Bryan. 328 pp. Hart, New York, 1969. \$12.50

HEAT, THERMODYNAMICS STATISTICAL PHYSICS

Probability and Stochastic Processes: With a View Toward Applications. By Leo Breiman. 324 pp. Houghton Mifflin, Boston, Mass., 1969. \$9.50

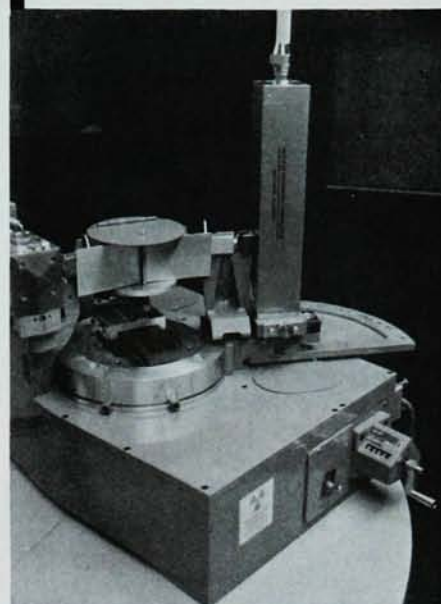
Mathematical Methods in Kinetic Theory By Carlo Cercignani. 227 pp. Plenum, New York, 1969. \$15.00

A Course in Thermodynamics, Vol. 2. By Joseph Kestin. 617 pp. Blaisdell, Waltham, Mass., 1968. \$15.50

Thermal Radiation Phenomena, Vol. 1: Radiative Properties of Air, Vol. 2: Excitation and Non-Equilibrium Phenomena in Air. 648 pp. and 288 pp. IFI/Plenum, New York, 1969. \$28.00 and \$14.00 □

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