fluence of temperature. In the discussion, E. Orowan deals with deformation bands and states that Barrett's deformation bands should be assumed to be kink bands.

5. B. E. WARREN & B. L. AVERBACH, *X-Ray Diffraction Studies of Cold Work in Metals* (pp. 152–166; discussion 7 pages). A formula is developed by Fourier analysis for the line-broadening due to distortion, which is considered to be the primary cause of broadening, rather than fragmentation. The theoretical predictions are compared with the results of measurements on cold-worked filings of (70/30) α brass. The discussion includes a communication of P. B. Hirsch 'An X-Ray Microbeam Investigation of Cold-Worked Aluminium'.

6. N. F. MOTT, *Mechanical Strength and Creep in Metals* (pp. 173–190; discussion 7 pages). The effects responsible for mechanical strength in metals are summarized; attention is given to the influence of impurities; the locking of dislocation lines is treated and a theory is given of exhaustion creep.

7. J. S. KOEHLER, *The Influence of Dislocations and Impurities on the Damping and the Elastic Constants of Metal Single Crystals* (pp. 197–212; discussion 4½ pages). A treatment is given for the motion of a 'pinned down' edge-type dislocation under the influence of a periodic external stress. An important factor in the total effect is the distribution of free lengths of dislocation. The results are compared with experiments. In the discussion, starting from an observation made by T. A. Read, the author of the paper adds a treatment of the motion of a screw-type dislocation under alternating stress.

Part III. Diffusion and Related Phenomena.

8. R. G. BRECKENRIDGE, *Relaxation Effects in Ionic Crystals* (pp. 219–245; discussion 1 page). Values of the activation energies for the motion of lattice defects in alkali halides, AgCl and thallium halides are deduced from observations on temperature and frequency for maximum loss of energy. The number of lattice defects present is found from the magnitude of the maximum loss. Both pure and impure crystals have been studied. The degree of association of lattice defects is calculated.

9. L. APKER & E. TAFT, *Studies of Alkali Halides by Photoelectric Methods* (pp. 246–260; no discussion). This paper discusses the production and distribution of '*F*-centres' (bound state of an electron at a halogen-ion vacancy; see Seitz's chapter, p. 65).

10. J. BARDEEN & C. HERRING, *Diffusion in Alloys and the Kirkendall Effect* (pp. 261–288; no discussion). The 'Kirkendall effect' is a mass flow relative to the initial interface of a diffusion couple, e.g. brass–copper (zinc diffusing out of the brass more rapidly than copper diffuses in). A theory is developed; the effect of dislocations is discussed, while some suggestions are made concerning the atomic nature of the plastic flow which takes place in this effect.

11. C. ZEHNER, *Theory of Diffusion* (pp. 298–414; no discussion). The problem considered is whether the elementary act of diffusion occurs homogeneously throughout the material or is confined to short-circuiting paths arising from imperfections. The latter case can explain the abnormally low values of the diffusion constant D_0 in chemical diffusion.

Part IV. Surface Properties.

12. J. G. FISHER & C. G. DUNN, *Surface and Interfacial properties of Single-Phase Solids* (pp. 317–343; discussion 7½ pages). The published values of surface and interfacial tensions of single-phase solids are collected and discussed critically. Surface tensions are given for Cu, Ag, Au; grain and twin boundary tensions for Cu; and the variation in grain boundary tension with orientation of adjacent grains is considered for Si–Fe, Sn and Pb. In the latter case the inclination of the interface with respect to the crystallographic axes of either grain is probably of less importance than the orientation difference between the two grains, in particular when this difference is small.

13. W. T. READ & W. SHOCKLEY, *Dislocation Models of Grain Boundaries* (pp. 352–371; discussion 5 pages). Starting from Bragg's and Burgers's models of a small-angle grain boundary, the following formula is derived for the surface energy as a function of θ (the direction of the axis of relative rotation being kept fixed): $E = E_0\theta(A - \ln\theta)$, where E_0 is calculable from the elastic constants, while A also involves the energy of atomic disorder immediately around a dislocation line. A good check is obtained with experimental data; even an estimate of the absolute energy comes out not too badly. In the discussion B. Chalmers considers effects of impurities.

14. C. S. SMITH, *Interphase Interfaces* (pp. 377–401; no discussion). Data concerning interfacial tensions are given for various systems; also solid–liquid data for a number of pure metals. The geometry of lattice interfaces is discussed.

15. A. GUINIER, *Substructures in Crystals* (pp. 402–436; discussion 5 pages). Guinier considers crystalline grains to be divided into 'subgrains', disoriented over a few minutes and separated by 'sub-boundaries'. The subgrains are produced by 'polygonization', as occurs, for instance, when a perfect crystal is slightly deformed and then annealed, without, however, producing recrystallization. The properties of sub-boundaries and their constitution is considered, in particular their relation to dislocation theory.

16. B. CHALMERS, *The Properties and Effects of Grain Boundaries* (pp. 441–450; discussion 1 page). The effects of grain boundaries on plastic deformation, the support of shear stress, their liability to fusion below the normal melting point of the metal and chemical properties are considered.

17. R. SMOLUCHOWSKI, *Movement and Diffusion Phenomena in Grain Boundaries* (pp. 451–471; discussion 4 pages). The present state of empirical data concerning the movement of grain boundaries is reviewed. Preferential diffusion along grain boundaries is also considered.

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Dana's Manual of Mineralogy. Revised by C. S. HURLBUT, Jr. Pp. viii+530, with 471 figs. and 22 plates. New York: Wiley; London: Chapman and Hall. 16th ed. 1952. Price $6·00; 48*s*.

The original author of the *Manual of Mineralogy* was James D. Dana, who was also responsible for the *System of Mineralogy*. The value of the *Manual* as a handbook of the subject, not only for professional mineralogists but also for mineral collectors, prospectors and mining

geologists, is attested by the fact that it has now reached its sixteenth edition. In doing so it has had several revisers, including as the latest Prof. Hurlbut of the Department of Mineralogy and Petrography of Harvard University.

The book is intended to appeal to a wider public than the relatively few who have access to laboratories equipped with elaborate optical and X-ray instruments upon which to rely for mineral identification. Thus the traditional methods of the mineralogist are fully treated; crystal morphology, the use of the blowpipe, the wet reagents and the dry reagents are all described. The present edition does, however, keep pace with modern developments by the inclusion of a brief discussion of X-ray technique in the excellent new introduction added by Prof. Hurlbut; and by the incorporation of a section on crystal chemistry. The silicates are classified on the structural basis developed by Bragg and Bragg, following in its details the arrangement of Berman. Among techniques, the emphasis is nevertheless laid upon the traditional rather than the contemporary, and one may perhaps ask whether the next edition might not be further enhanced by the addition of optical and X-ray data.

In the section on crystallography, the abandonment of the Dana crystallographic nomenclature is to be welcomed. Miller's indices are now given, certain forms being lettered. A table shows the 32 crystal classes and here Hermann–Mauguin symbols are stated in addition to the older symbols. Chapters on physical mineralogy and chemical mineralogy follow that on crystallography, and there is a section on descriptive mineralogy which deals with some 200 species, including all the common minerals. A few of the best-known localities are quoted in each case, including some non-American sources. The succeeding chapter on the uses of minerals is, perhaps naturally, mainly devoted to production in and for the United States. Determinative mineralogy is summed up in a series of tables in which the orders of classification are: (1) Lustre; (2) Hardness; (3) Streak; (4) Colour; (5) Specific gravity. There is a useful mineral index giving, in addition to page references, the composition, crystal system, specific gravity, and hardness of each mineral.

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Chemische Analyse der Gesteine und silikatischen Mineralien. By J. JAKOB. Pp. 180, with 10 figs. Basel: Birkhäuser. 1952. Price bound 18·70 Swiss francs.

The technical development in modern society has resulted in the disappearance of fine craftsmanship in many trades. A similar phenomenon can be observed in science, where new instruments and techniques can make routine business of measurements which once required the hands of a skilled and experienced scientist. The 'art' of crystal measurement with the single-circle goniometer passed in this fashion, changing into a comparatively simple job after the introduction of the two-circle instrument. Another example is the subject covered in Jakob's book, a publication in which an old master of chemical analysis makes available his decades of experience in this field.

This volume is the seventh of the chemical series in the excellent collection 'Lehrbücher und Monographien aus dem Gebiete der exakten Wissenschaften', published by Verlag Birkhäuser. It is definitely a 'Lehrbuch', and illustrates what a textbook on analytical methods should offer to beginning students. Though the author does not claim to describe more than the analysis of rocks and minerals, he furnishes his readers with a wealth of information on the general practice of analytical determinations, giving not only the 'know-how', but also the 'know-why' of every manipulation.

The methods are carefully selected to give untrained students a fair chance at dependable results. These techniques are explained in the main portion of the book, comprising 150 pages. A special section of 25 pages deals with the difficulties arising in the analysis of silicate minerals, which deviate considerably from the 'mean' composition of rocks; and a short appendix gives information on the preparation of colorimetric solutions and on the accuracy of rock analyses.

Chemists concerned with analyses of mineral- and rock-like substances can profit from the reading and use of Jakob's book. Even trained analysts might take advantage, for example, from the author's emphasis on the removal of adsorbed matter from colloidal precipitates by repeated dissolving and precipitation instead of by inadequate washing on the filter. Advanced workers will be disappointed if they look for modern determinations using complex-forming organic compounds, spectroscopes, polarographs or electronics; but they will be delighted to find classical methods, which once formed the sole source of quantitative data in chemistry, developed to a high degree of reliability and described with painstaking care.

The author, well-known in his country also as a writer on popular science, uses a clear and oftentimes kind-hearted language, thus giving foreign students a good opportunity to exercise their German. The make-up of the book matches the high standard of the other Birkhäuser volumes, although the volume unfortunately does lack an alphabetical subject index.

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Cristaloquimica. By JOSÉ LUIS AMORÓS. Pp. 147. Barcelona: Instituto Lucas Mallada. 1951.

This little book (150 pages) is intended by the author to serve as a manual for students of crystal chemistry and for workers in the field of crystal-structure determination. It contains chapters dealing adequately with the types of atomic bonding, the energy of ionic and other crystals, atomic radii, the principles of crystal structure, structural types, isomorphism, polymorphism, and the chemistry of solids. Each subject is treated accurately and succinctly, and numerous figures and tables add clarity and usefulness to the text. A bibliography is appended of works in which more thorough treatments of the various subjects can be found. This book should be very helpful to students of modern crystallography whose native tongue is Spanish.

Señor Amoros is to be congratulated upon his authorship of this little volume.

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