

in the equations of the earlier work, effects an esthetic improvement by favoring neither component of a binary mixture in applying corresponding states; his reference substance is a defined equimolar hybrid of the two pure components, so that the resulting equations are both simpler and completely symmetrical. From the final confrontation of theory with experiment, one sees clearly why more experimental data on mixtures of the simplest molecules are imperative and now actively being obtained, and also that the old ignorance about forces between unlike molecules is still very much with us.

As might be guessed, the thermodynamic symbols used are  $U, H, F, G$ . By now we have no trouble in reading that language, but it is much harder to get used to the inflationary though legitimate joule as the energy unit. The reader will find that Rowlinson has adopted yet another definition of "regular solution," a harmless pastime which can be expected to infuriate certain of his predecessors. He will also find the inevitable boner in a footnote on page 6, but he will perhaps be surprised to find almost nothing about volume fractions as concentration units, for the author argues that they are rarely worth the trouble. The reader may also feel that inordinate amounts of history and priority have been ignored.

This book could well be used in a graduate course, although one would skip over some of the compilatory sections. As a reference work, it is highly recommended to both research scientists and engineers whose basic thermodynamics and statistical mechanics have been previously acquired and not allowed to rust very long. In no other single volume can they find such an authoritative and well-balanced account of the present experimental and theoretical state of this perpetual part of chemistry.

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**X-Ray Metallography.** By A. TAYLOR, Advisory Physicist, Westinghouse Research Laboratories, Pittsburgh, Pennsylvania. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1961. vii + 993 pp. 16 × 23 cm. Price, \$27.00.

If anyone has the slightest doubt of the spectacular growth of X-ray science in all branches, and of X-ray metallography in particular, he has only to compare Taylor's 1961 version (written in Pittsburgh) with his introductory text (written in England) published about 15 years ago. Both were written with the same objectives of providing the metallurgist an appreciation of X-ray methods as they apply to his particular field of work, in a book which "can be studied without prior knowledge of the subject, and particularly directed to the student reading for a degree and to research workers in university and industrial laboratories."

It is a tribute to this eminent authority that so much material is contained in about a thousand pages which might well have required several volumes. With a characteristically clear, conversational style, even the novice will find reading of descriptive matter surprisingly effortless, interesting and genuinely rewarding. There are, of course, some chapters presenting rigorous mathematical derivations, essential to the X-ray diffraction process, which will be tough going and discouraging for those "without prior knowledge of the subject" for whom the book is intended; but at least an incentive is provided for intensive further study. Instead of compromising by "writing down" to his readers, the author indeed sets a high standard for them. If they are to become able research X-ray metallographers, not just technicians, they see here clearly what mastery of the science entails.

The order of topics, upon which there might be a considerable divergence of opinion by readers and by experts, depending upon their specific backgrounds and interests, is briefly as follows: scope and history of X-ray metallography; generation and absorption of X-rays; radiography, microradiography and X-ray microscopy in general; external and internal symmetry of crystals; diffraction of X-rays by a simple primitive lattice; experimental diffraction methods; X-ray tubes; intensities of X-ray reflections;

crystal structures of elements; thermal equilibrium (phase-rule) diagrams; crystal chemistry of alloys; precipitation hardening, complex alloys and steels; orientation textures; size and perfection of grains; internal stresses in metals and alloys; chemical analysis by X-ray procedures; applications to refractory materials, oxides and corrosion products. A hundred-page appendix presents in condensed form useful tables and information on techniques, and there are many tables closely related to the text throughout the volume.

What, then, are the distinctive qualities of this contribution? In the unreserved opinion of this reviewer, after 40 years of experience in the general field, this is the most complete coverage of X-ray science, in fundamental aspects as well as in metallurgical, chemical, physical and engineering applications, ever accomplished in a single volume by a single author. A check on 1959-1960 developments (such as the Lang diffraction-microradiograph technique, p. 766; the Land-Polaroid instantly-developed X-ray film; new findings in neutron radiography, etc.) reveals that the author has kept abreast of progress. Beyond any doubt this is the most completely documented manuscript ever published in this field, for the Bibliography at the end of each chapter is truly complete and accurate. While inevitably some topics are more adequately treated than others, perhaps because of space limitations, the admiration of the reviewer grew page by page during reading of long familiar subject matter. Especially masterly in treatment were such items as the powder diffraction method in general (of course of principal interest in metallurgy), the design (by the author) of high-intensity rotating-target X-ray diffraction tubes, order-disorder phenomena in alloys, dislocations, analysis of ternary and more complex alloys, the martensite phase in steels, evaluation of texture by pole figures, grain sizes and internal stresses. Oversights or omissions in such a wealth of material are surprisingly few. There is no mention of the rad, the unit of dosage which is largely displacing the older roentgen; or the Buerger precession goniometer. Though briefly mentioned in several places there is a feeling that the concept and usefulness of the reciprocal lattice are slighted while some other features, especially mathematical, are overweighted.

The book is well printed with only 4 minor errors noted, and the 416 figures are clear and useful. The 27-dollar price, almost prohibitive for the "student reading for a degree," makes one wonder when will these spiraling costs of books level off. Suffice it to say, however, to the author—well done and a genuine service to science. Chemists who read this evaluation will find this book just as applicable and useful and challenging as will the metallographers.

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**Cahiers de Synthèse Organique. Méthodes et Tableaux d'Application. Volume VI. Rearrangement et Migration.** By JEAN MATHIEU and ANDRÉ ALLAIS. Published under the direction of Léon Velluz. Masson et Cie., 120 Boulevard Saint-Germain, Paris 6, France. 1960. 417 pp. 15.5 × 22 cm. Price, 120 NF.

Of the 417 pages in this volume, 276 are devoted to an up-to-1959 review of contributions related to rearrangements and isomerizations. The selection is largely from the area of synthetic organic chemistry and appears reasonably comprehensive from the point of view of reaction types. References to transformations in the field of natural products are only incidental.

In the manner of the earlier volumes in this series, an attempt is made to codify the various reaction types. Considerable success was achieved judging from a few tests made by the reviewer to locate references to reactions. The review should prove useful to those with only a very rudimentary knowledge of the French language since throughout extensive use is made of the universal language of structural formulas.

The organization of each of the four chapters involves first a synopsis of the coding system with reference to page numbers. This is followed by undocumented sections on principles, mechanisms and application. Thereafter, the above-mentioned reviews are presented. The sections relating to principles are merely brief explanations of the