metals do not receive sufficient attention; only two papers have the word metal in their title, and only a few of the other papers are relevant to a study of metals. Another comment is that there is strong evidence in this book of the tendency among rheologists to adopt broader points of view instead of solving very specialized problems with special techniques. For this reason all rheologists will gain by a perusal of all sections of the volume.

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Vapor Pressure of Organic Compounds. T. Earl Jordan. Interscience, New York–London, 1954. ix + 266 pp. Plates. $14.50.

The chemical engineer will find this huge compilation of vapor pressure data useful since it is possible to read the vapor pressures of 1492 organic and organometallic compounds to about ±1 percent from 168 well printed charts that constitute the heart of the book. These charts are supported either by equations or by references to 1145 tables of vapor pressure-temperature points. Unfortunately the book will not be of much value to physical chemists or to engineers who desire to make their own evaluations. There is no indication whether the tables of values refer to calculated or observed values although most of them contain calculated or smoothed results; and since the author has relied on secondary references to a major extent, his book does not provide a guide to the original literature.

The one page of text and a short preface emphasize that fact that the book is a summary of data, in fact, largely a summary of summaries, but no criterions of judgment are mentioned except graphical examination.

Comparison with D. R. Stull's compilation [*Ind. Eng. Chem.* 39, 517 (1947), reprinted in alphabetical order in *Chemical Engineers' Handbook,* J. H. Perry, Ed. (McGraw-Hill, New York, 1950)] of the evaluated vapor pressure data on over 1200 organic compounds and about 300 inorganic compounds is inevitable because Stull's collection is easily available and Jordan has reproduced 908 of Stull's tables verbatim. This is unfortunate because these values contain noticeable errors just below the normal boiling point, owing to a flaw in Stull's original chart; it would have been better if the basic data had been reworked or at least checked before such an extensive reprinting.

It is impossible to make more than spot checks on the values themselves. However, for 1,2-dibromoethane between 0° and 50°C we have a choice of two equations and the chart, but no two of them agree or even cross. At 10°, one equation gives 4.7 mm, the other 5.9 mm, and the chart 6.6 mm. At 50°, the three values are 42.3, 43.4, and 46.0 mm, respectively. The chart for tetraethyl lead (pl. 3, not 2) is said to be based on the work of Buckler and Norrish (0.056 to 6.3 mm) and on Stull's calculated values based on the same experiments. However the chart line does not correspond to Buckler and Norrish's equation but has a much smaller slope, and their experimental points lie 12 to 25 percent below the chart line. The author also missed the four points at 10, 13, 19, and 290.5 mm by W. J. Jones *et al.* [*J. Chem. Soc.* (London, 1935), p. 39].

Several other examples of this essentially noncritical treatment were evident on close examination of the tables and charts. Since the ordinate scales of the charts are linear with the logarithm of pressure and the abscissa scales are linear with reciprocal absolute temperature, a gentle curavature is expected for the plots of all but very low boiling point compounds. Instead, there are one or more straight lines per compound, sometimes with a disconcerting change of slope (for example, benzene at 100 mm on pl. 7).

In conclusion. I feel that the book has little utility, for the physical chemist and chemical engineer are better served by existing compilations, and the organic chemist dealing with relatively unknown materials will profit by the use of Dreisbach's book [*P-V-T Relationships of Organic Compounds* (Handbook Publ., Sandusky, 1952)] of vapor pressure estimates rather than by attempts to interpolate estimates based on Jordan's charts.

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Tissue Culture as Applied. Especially within bacteriology and immunology. Ren Kimura. Munksgaard, Copenhagen, Denmark, 1953. 273 pp. Illus. Danish Kr. 14.

This review is designed to summarize some 260 papers published by Kimura and his associates from the Microbiological Institute of Kyoto University. The procedure is to cite first the pertinent literature available prior to World War II, and then the findings in Kimura's laboratory. The broad range of subjects includes: culture mediums and techniques; pure cultures of tissue cells, cultures from various organisms and from malignant tumors; morphology, metabolism, vital staining and phagocytosis; and bacteriological and immunological studies.

Two general areas (factors influencing growth and immunological studies) encompass the major work of this laboratory. The factors studied for their influence on growth were temperature, desiccation, osmotic pressure, ionic concentrations, chemotherapeutic compounds, antibiotics, radiation, homologous and heterologous blood plasma, organ extracts and hormones, and vitamins. Immunological observations include the effects on cells of bacterial toxins, venoms, viruses, Rickettsiae, and cytotoxins. Antibody production has also been studied. Kimura's encyclopedic assembly of observations serves to point out topics on which experiments have been conducted but does not attempt to evaluate the implications of the findings.

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Copper. The science and technology of the metal, its alloys and compounds. Allison Butts, Ed. ACS Monograph Series, No. 122, William A. Hamor, Ed. Reinhold, New York, 1954. xii + 936 pp. Illus. $20.

This volume is one of the monograph series of the American Chemical Society. It contains 46 chapters, each written by one or more of the leading international authorities, on all the various phases of the technology of copper. The volume is encyclopedian in its scope.

The stated purpose of this composite monograph is "to provide a reference work on all the important phases of the subject of copper both as a chemical element and as an industrial metal." This objective has been carried out admirably, and the resulting volume, containing nearly 1000 pages, should occupy a space on the reference shelf of every engineer, metallurgist, chemist, and technical or scientific worker whose operations bring him in contact with the element copper in any of its forms and applications.

The metallurgical phases of copper are, in general, particularly well covered and, in most cases, with adequate detail, but some aspects might have been more expanded. For instance, the chapter on "Electrolytic refining" occupies 57 pages with 23 references. The subject is exploited in the fullest detail and with perhaps more detail than its relative importance would seem to demand. On the other hand, "Secondary copper and copper alloys" (Chapter 16) is covered in only 8 pages with no references. Considering the very great importance of this subject in our present-day economy, more space should have been assigned to it. The methods of refining secondary material are described only in such general terms that the inclusion of this chapter, as written, seems scarcely worthwhile.

In Chapter 7, the thermodynamics of copper smelting occupies 16 pages with 18 references. The introductory material of this chapter, especially in regard to free-energy changes, could have been treated in more detail. Unless the reader has a good, up-to-date, and working knowledge of modern physical chemistry, he is not likely to be able to apply the equations appearing on pages 152 and 153, even though it is stated:

> If the activity values are known, the free-energy changes accompanying reaction with reactants and products at any other than standard states can readily be obtained by combining the Δ °F values from the graphs with equation (2).

The reader is told that "A" equals the activity of a constituent. When he turns to his physics textbook he finds that "activity" is defined as the ratio of the fugacity of the substance in the state in which it happens to be to the fugacity in the standard state. When he seeks a concise definition of "fugacity," he jumps into really deep water.

Again, in the treatment of "Analytical chemistry of copper" (Chapter 46), slightly more detail could have been given. Even though it is stated that "the analytical chemistry of copper is reviewed rather briefly" and that "Due to space limitations no attempt is made to give the details of the laboratory procedures," nevertheless, the commonly used and accurate electrolytic method receives a thorough treatment (3½ pages and about 50 references). Although the gravimetric, iodiometric, and other methods, including the colorimetric method, are discussed and amply referenced, it might have been advantageous to include some details of one of each of these methods. This chapter contains 106 references.

Most of the chapters cover their subjects in an adequate and excellent manner, and the book covers the whole subject of copper in practically all its ramifications in a most commendable fashion, including 1289 references to the literature from about 1933 to as late as 1952. Unfortunately, however, six chapters have no references at all. This fact, together with the poor reproduction of at least two diagrams (pages 105 and 157) in which some of the numerals are completely blocked up and undecipherable, is about the only valid criticism that can be made. Only one typographical error was found (page 536), and this was a minor one.

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Optical Workshop Principles. Translation of *Le Travail des Verres d'Optique de Précision.* Charles Dévé. Trans. by Thomas L. Tippell. Hilger & Watts, London, and Jarrell-Ash, Newtonville, Mass., Engl. ed. 2, 1954. xxiv + 436 pp. Illus. + plates. 42s.

The first English edition of this work was prepared by Hilger to provide a manual for the training of the many optical workers needed in World War II. The present edition was translated from the third French edition, most of which was written in 1945 and published in 1949. The apparent age of the French original does not detract from the value of the book as a guide to the rationale of optical shop practice.

The author pointed out that the manual was written for apprentices, teachers, shop managers, and others who already know something of the practice of optical surfacing. Some elementary subjects, such as the design and mechanics of grinding machinery, are not discussed. Thus the book is in the nature of a monograph on selected topics of optical work, but the treatment of these is so thorough and practical that it is useful to workers in any stage of training.

The first part of the book, "Elementary," is devoted to glasses, their faults and aberrations; choice of materials; abrasives, glues, cements, tools, polishers; surfacing; and spectacle lenses. The second part, "For the use of works managers and senior workmen," takes up the mechanical theory of working optical surfaces; optical tests in the workshop; polarization of light; crystal working; the construction of several types of polarizing prisms; centering, edging and cementing lenses; reticules, micrometers, graticules; the metallization of mirrors. There are three appendixes; the most significant is on the surfacing of aspherical lenses. There are author and subject indexes. Only a