TABLE I

	Amt. compd. nec. for complete inhibition of growth, μg./ml.			
	Stephenson–Whetham's synthetic medium (modified)		—Bouillon agar medium—	
	E. coli[a]	*B. subtilis*[b]	*E. coli*[a]	*B. subtilis*[b]
Gramicidin S sulfate[c]	>100	10	>100	10
XV	>100	1	>100	20

[a] *Escherichia coli* IFO 3044. [b] *Bacillus subtilis* PCI 219. [c] A product of Astra Co., Worcester, Mass. This contains 8 moles of water of crystallization.

equal activity to that of the natural bradykinin.[17]

(17) M. Bodanszky, J. T. Sheehan, M. A. Ondetti, and S. Lande, *J. Am. Chem. Soc.*, **85**, 991 (1963).

On the other hand, it appears that the valine residues in gramicidin S are of importance for the activity because the cyclo-(glycyl-L-ornithyl-L-leucyl-D-phenylalanylglycyl)$_2$ showed very weak activity.[5] To clarify this point, a synthesis of cyclo-(glycyl-L-ornithyl-L-leucyl-D-phenylalanyl-L-prolyl)$_2$ will be the subject of a subsequent publication.

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BOOK REVIEWS

Vapor Pressure of the Chemical Elements. By A. N. NESMEYANOV, Director, Institute of Elemento-Organic Compounds, U. S. S. R. Academy of Sciences, Moscow. Edited by ROBERT GARY, National Bureau of Standards, Washington, D. C. American Elsevier Publishing Co., Inc., 52 Vanderbilt Ave., New York 17, N. Y. 1963. 462 pp. 17 × 25 cm. Price, $17.50.

An incredible and inexcusable mistake has been made by the editor and the publisher: the author of the book has been misidentified! The man deserving the credit is Andrey (abbreviated An.) N. Nesmeyanov, not his brother Aleksandr N. Nesmeyanov, the organic chemist and former president of the U. S. S. R. Academy of Sciences. In two lines on the title page that do not appear in the Russian original, the institutional affiliation of the wrong man is listed; and on the printed dust jacket, the birth date and achievements of the organic chemist are advertised. The author is at Moscow State University where he has engaged in many vaporization studies and radiochemical investigations. He is therefore able to write from practical experience, and the book is far more authoritative than if it had been written by his brother.

The book itself can be divided into six parts: (1) a large Chapter I entitled "Methods for Measuring Vapor Pressure"; (2) Chapters II–IX containing data and discussions on the vapor pressures of the elements arranged according to the periodic table groups; (3) a short, misnamed Chapter X entitled "Theoretical Vapor Pressures and Heats of Sublimation of Elements"; (4) 695 references; (5) 39 pages of reference tables; and (6) a subject index. A serious shortcoming is the lack of an author index.

In the first chapter of 121 pages, the author describes the various experimental methods of vapor pressure measurement. He is to be commended for the excellent and comprehensive coverage of the literature, with some very old and some very new methods receiving attention. The Russian literature is emphasized. Many good drawings of apparatus are given, and several of the author's own experimental apparatuses are described. The great desirability of the use of radioactive tracers in several different types of measurements is very appropriately emphasized. The isotopic exchange method of vapor pressure measurement, which was developed by the author but which has not been extensively used as yet, is discussed at length. Anyone wishing a summary of vapor pressure methods or ideas for attacking particular vapor pressure studies should find this chapter rewarding.

The most serious shortcoming in the first chapter is the treatment of subjects that are not yet fully understood. Twice on page 52 and on pages 104 and 116, there are declarative statements concerning vaporization coefficients and orifice size, residual gas effect, surface condition, and absolute pressure measurements by mass spectrometry which are directly contradictory to sentences in preceding paragraphs. It would have been far better to put the ideas in adjacent sentences and simply to state that the problems are not resolved.

The Knudsen method is properly evaluated as "the most reliable one for measuring low vapor pressures"; but the evaluation of the so-called "differential" Knudsen method is too harsh. The introduction to the Langmuir method contains some misleading statements, and the mass spectrometric technique is probably underestimated on page 117. The flow method is capable of great precision, contrary to the statement on page 35, and the treatment of the diffusion correction at low flow rates in this technique is inadequate. Specific errors occur on page 73 in eq. 63 which does not contain K and on page 68 where it is stated that log $I\sqrt{T}$ (rather than log IT) plotted against $1/T$ is parallel to log P *vs.* $1/T$.

The table of contents concerning Chapter I is confusing. For example, mass spectrometry is discussed partially in a sub-subsection entitled "Determination of Vapor Pressure from the Density of the Molecular Beam" in a subsection entitled the "Knudsen Effusion Method," and also in a sub-subsection entitled "Vapor Composition and Methods for Measuring It" in an unlettered subsection entitled "Influence of the Langmuir Coefficient and the Molecular Composition of the Vapor on the Results of Vapor Pressure Measurements." This last section is worthwhile reading, but little that is definitive appears.

In the following chapters on the vapor pressures of the elements, the author has considered practically all the published work except for H, N, O, and the noble gases. Numerous tables of published measurements are given and several vapor pressure graphs are included. One hopes that in a book of this kind he can find a critical and definitive discussion of all the work, ultimately a choice of a value for the property in question, and an estimate of the reliability of the chosen value. In this regard the book is a disappointment. Nowhere is the reliability of the chosen value given, and the discussions are not sufficiently clear, definite, and critical to command confidence in the value. Controversy exists at the present time concerning the vapor pressures of boron and uranium, and the book contributes little to the solution of either problem. Entirely properly and at numerous places, the author notes the desirability of additional work.

The reference tables near the end of the book will probably be used most. In the first a most useful set of references, which were considered in the preparation of the book, is arranged according to the elements.

The chosen vapor pressure data are presented in five different ways in Tables II–XXVI. The methods that were used for the evaluation of published data and for the preparation of the tables are almost hidden on pages 393–397, but these should certainly be read by one wishing to use the tables.

Table II contains computed coefficients for a four-term vapor pressure equation, of use perhaps to engineers. Table III contains a summary of gaseous species, melting point, heat of fusion, the computed boiling point, the chosen $\Delta H°_{298}$, and the values of this last quantity from Honig[1] and Stull and Sinke.[2] Appreciable differences exist for Au, B, Al, Y, Ce, Gd, Lu, Si, Hf, As, Bi, Pa, Fe, Co, Ni, and Os. The usefulness of this table will

(1) R. E. Honig, *RCA Rev.*, **18**, 195 (1957).

(2) D. R. Stull and G. C. Sinke, "Thermodynamic Properties of the Elements," Advances in Chemistry Series, No. 18, American Chemical Society, Washington, D. C., 1956.

be greatly hampered owing to the omission of free energy functions.

Table IV contains the computed boiling points at different pressures; Tables V–XXV contain the computed vapor pressures at even temperatures; and Table XXVI contains the computed vapor pressures at the melting points.

An interesting graph giving the pressure ranges of the experimental methods is presented on page 119, and another giving the pressure ranges over which the vapor pressure of each element has been measured appears on pages 394–395.

The book can be used in three ways, one of which is excellent, one very good, and one terrible. It should be an excellent source of information on vapor pressure methods, especially for those just entering the field. It provides a large and very useful bibliography, which, however, contains many errors. Its tabulated results should be used as they appear only by one who wishes numbers regardless of their reliability.

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Fused Salts. Edited by BENSON ROSS SUNDHEIM, Department of Chemistry, New York University. McGraw-Hill Book Co., Inc., 330 West 42nd St., New York, N. Y. 1964. 435 pp. + ix. 16 × 24 cm. Price, $18.50.

This is a valuable book for acquainting the scientist with the state of the art in most aspects of molten salts. It consists of seven reviews in various fields of fused salt research, each written by one or two authorities in the field. Most of the reviews discuss the results of the application of one broad discipline to the study of molten salts. In general, the authors assume the reader has more than an elementary acquaintance with the theory of the discipline. As a result, the book will be useful to the researcher in fused salts interested in results from the application of other disciplines than his own, or to the researcher who is concerned with the disciplines themselves and interested in their application to fused salts. This volume probably will have little value for the undergraduate student.

On the whole, the reviewer considers this to be a good book. It has the advantages that arise from being written by several authorities on the subject. The technical level is high, and the content reflects the latest thinking on the subject of molten salts. Most of the authors point out areas that would probably prove fruitful for further research—an attractive feature. Unfortunately, the book also has the disadvantages of a compilation of a set of review papers. There is a certain amount of duplication of effort, some of which is helpful, but some should have been edited out. Also there is a lack of consistency of the symbols used from one chapter to the next. This last is not serious, however, since the reader should be familiar with the various sets of symbols.

Chapter 1, "Structural Aspects of Ionic Liquids," by H. Bloom and J. Bockris, starts with a review of various theories of liquids as applied to fused salts. This is followed by a digression into transport phenomena, which might well have been left to the chapter on the subject. An interesting comparison is then made of the ability of the various theories to predict data. The closing section discusses evidence for identifiable species in mixtures and the meaning of complex ions in fused salts. This reviewer found it strange that the authors completely ignored the very important X-ray studies of pure fused salts.

Chapter 2, "Thermodynamic Properties of Fused-Salt Systems," by T. Førland, is an excellent discussion of the subject. After a brief introduction the author derives the thermodynamics of mixtures for various structural assumptions. This is followed by a review of experimental methods. The concluding section covers experimental results and their significance regarding species and complex ions in melts.

In Chapter 3, B. Sundheim reviews "Transport Properties of Liquid Electrolytes." This starts at a very sophisticated level, but a persistent reader will find things get easier as he progresses. In fact, it might be recommended that the three sections of this chapter be read in reverse order. The last section, Discussion, is a very readable account of the concepts involved. The Experimental Methods section provides a compilation of data as well as a good description of methods. The first section on Phenomenological Treatment discusses the application of the thermodynamics of irreversible processes to transport in molten salts and requires some background in the field for complete understanding.

"Electrochemistry in Molten Salts" (Chapter 4) by H. Laitinen and R. Osteryoung specifically excluded "static" electrochemical methods, presumably because this is well enough treated in other recent reviews. The authors discuss several comparatively new techniques from aqueous electrochemistry which have been applied recently to fused salts. These are primarily chronopotentiometry, impedance methods, pulse techniques, and polarography. The methods hold promise of providing information on the kinetics of electrode processes. To date, however, the results seem to be primarily diffusion coefficients of cations dissolved in fused salt solvents.

D. Gruen presents a very interesting account of "Spectroscopy of Transition Metal Ions in Fused Salts" in Chapter 5. In an introductory section he describes the spectra of salts that can be used as solvents. Then he gives an interesting discussion of the spectra of 3d ions in chloride melts—how the spectra give the symmetry of the field around the cation and hence the species or complex in which the ion exists. Results for 4f and 5f ions are subsequently discussed, but these are not so readily interpreted.

Chapter 6 is concerned with the "Solution of Metals in Their Molten Salts," and J. Corbett has presented an excellent review of this subject. An historical introduction is followed by a section on experimental methods. A discussion of experimental results follows. The final section presents the theories and models proposed to account for the properties of these solutions. The chapter reflects an effective survey of the literature for hard-to-find, pertinent references and the author presents a careful, impartial evaluation of the data. His closing quotation from Robert Frost seemed particularly appropriate.

Chapter 7, "Reaction Kinetics in Fused Salts," by F. Duke, is a brief review of a half-dozen of his own papers. The reader may feel that, by reviewing only his own work, the author is unduly egocentric. However, a little investigation will show that there is, indeed, very little other work except some studies of the decomposition of pure salts, and the author is justified in treating only his own papers.

It seems worthwhile to call the readers' attention to some recent, related books. "Molten Salt Chemistry" edited by M. Blander (Interscience Publishers, New York, N. Y., 1964) is a very similar compilation of several treatises by different authors. The book "Electrochemistry of Fused Salts" by Iu. Delimarskii and B. Markov, translated by A. Peiperl and R. Wood (Sigma Press, Washington, D. C., 1961), covers electrochemistry only. There is also a recent handbook of data on fused salts: "Physico-Chemical Constants of Fused Salts," edited by the Committee of Fused Salt Chemistry, The Electrochemical Society of Japan.

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Chemistry in Nonaqueous Ionizing Solvents. Volume IV. Chemistry in Lower Fatty Acids and Derivates. By KURT HEYMANN, HEINRICH KLAUS, HORST SURAWSKI, GERHARD WINKLER, HERBERT KNAUER, and LYLE R. DAWSON. John Wiley and Sons, Inc., 605 Third Ave., New York 16, N. Y. 1963. 313 pp. 17 × 24.5 cm. Price, $12.00.

A voluminous literature exists in the area of nonaqueous solvent chemistry. This literature is scattered through many chemical journals, and the beginning worker is faced with a formidable task when he attempts to familiarize himself with previously published work in a given solvent. The series of monographs initiated by the late Gerhard Jander and by Hans Spandau and presently edited by Hans Spandau and C. C. Addison are designed to gather together in one place the literature pertaining to one solvent or a series of closely related solvents. This volume is fourth in a series "Chemistry in Nonaqueous Ionizing Solvents" and specifically concerns itself with the solvents formic acid, acetic acid, acetic anhydride, acetamide, and formamide and derivatives of amides.

Chapter 1 by Kurt Heymann and Heinrich Klaus, "Chemie in wasserfreier Essigsäure" (127 pp.), is an extremely thorough compilation of the acetic acid literature. Salient features of most of the articles discussed are given including much original data and figures. The material is presented systematically, starting with the discussion of the properties and preparation of acetic