Book Reviews

Reactivity of Inorganic Substances. Handbook. Revised and Augmented Edition. By R. A. Lidin, V. A. Molochko, and L. L. Andreeva. Begell House Inc., New York. 1996. 938 pp. $165.00. ISBN 1-56700-050-9.

This volume, translated from the Russian, furnishes data and describes the reactions, in the form of chemical equations, of 105 chemical elements and more than 7000 inorganic compounds. Thus, the only organic compounds which appear in the chapter on carbon are methane and acetylene and the inorganic compounds from which they can be prepared, e.g., carbides.

The chapters are organized alphabetically, each beginning with the symbol of the element. The initial entry consists of a table which lists half-reactions and the corresponding value of the reduction potential. This is followed by a paragraph which describes the physical properties of the free element such as the melting and boiling points, density, color, and its allotropic forms. There follow tabulations of the reactions of the free element and then its various compounds. The reactions of the compounds are also organized alphabetically, e.g., $AlBr_3$, $AlCl_3$, AlF_3, AlI_3. Temperatures at which the reaction are carried out and the identities of catalysts are also given.

Also very useful are descriptions of the physical properties of the reactant whose reactions are described. These include their color, basic physical and chemical properties, and solubility characteristics. Another useful feature is the inclusion of both laboratory and industrial methods of synthesis.

This volume furnishes an informative and useful compilation of the chemical reactions of elements and compounds. It will be very useful to chemists and chemical engineers as well as to biochemists and those who are interested in chemical reactions which can occur under a variety of environmental conditions.

The sources of the reported data are not given so that the reader is not informed about the criticality of the information. Consequently, there is no way to make judgments as to whether the data reflects the most recent literature.

In summary, this book presents a vast and very useful compilation of the reactions of the chemical elements and their compounds. It is a volume to which practicing chemists and chemical engineers will make frequent reference.

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Handbook of Thermodynamic Tables. Second and Revised Edition. By Kuzman Razjnevic. Begell House, Inc., New York, 1995. 247 pp. $77.50. ISBN 1-56700-046-0.

The major contents of this book are Table of Contents, Tables of Data, Appendices, References, and Index. No mention is made about the date of publication or circumstances of the first edition.

The bulk of the book consists of tables of numerical values of thermodynamic and transport properties such as temperature of phase transitions, heat capacity, enthalpy, entropy, *PVT* data, thermal conductivity, viscosity, and thermochemical properties. These are organized into four main sections: Solids, Liquids, Vapors, and Gases. Most of the data values refer to pure compounds, but a few tables contain data for high polymers, metal alloys, minerals, air, and other materials of industrial importance. The chapter on Vapors occupies about half the contents of the book and primarily concerns refrigerants. No phase equilibrium data for mixtures are included.

The tables are well organized and clearly presented. All numerical data are presented in SI units. It includes a convenient Table of Contents and Index so that information can be readily located. It appears intended for use by chemical, mechanical, and refrigeration engineers and similar technologists. For this use it furnishes a compact collection of data values.

A list of about 60 references is included. Presumably, these are the source of data in the book, although no specific statement is made about them. There is no indication about which reference was used for any particular data value. All the citations identify other handbooks and compilations. Of these all except 3 were published before 1964. No indication is given about how the data were selected from this diverse set of tables or of whether they were derived from observation or by estimation.

Thus it does not contain information gathered in recent decades and cannot be considered as a source of accurate or evaluated data. It cannot be assumed that the number of significant digits used for the numbers bear any relationship to the expected accuracy.

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Constants of Inorganic Substances. A Handbook. Revised and Augmented Edition. By R. A. Lidin, L. L. Andreeva, and V. A. Molochko. Begell House, Inc.: New York. 1996. 444 pp. $97.50. ISBN 1-56700-014-X.

As stated by the authors, "this handbook includes the data on more than 4000 substances, ions, and radicals chosen with due regard for their industrial and scientific importance." Additional features include a formula index for finding information on the 3127 chemical species listed in Chapter 1, a section on nomenclature, and a listing of inorganic substances with their English, French, German, and Russian names. There are seven (7) chapters to this book: inorganic physical property and reactivity data (168 pp), atomic properties (11 pp), molecular properties (41 pp), thermodynamic properties (123 pp), solubility (46 pp), nomenclature (53 pp), and references (2 pp). Each chapter has numerous subsections.

A short paragraph in the Preface indicated that the materials included in this "American" edition (this is the

author's terminology) were revised and complemented with modern data. However, the thirty-seven (37) references on which the data in the handbook are based only have six references published since 1985. These latter six references deal with inorganic synthesis (1986), analytical chemistry (1989), problems in inorganic chemistry (1990), chemical encyclopedia (1988−1995), and nomenclature (1988). These are not references which I would consider as sources of up-to-date data, nor are they the typical source of evaluated numeric data. The majority of the references are Russians handbooks, compilations, and evaluated data sources: twelve (12) are translations from English (6), German (5), and Hungarian (1), with an additional two American and one German publications.

It is not clear what the predecessor of this edition is. The copyright page refers to a second edition, which was published in Russia, with a 1993 date. There is no indication as to the first edition. The preface does mention two additions for the "American" edition: (1) the enthalpy and entropy of phase transitions and (2) an index of minerals. These are useful additions for the handbook, but the apparent sources are not current.

In addition, it is important to note that the data in this handbook are not taken from the primary data, but data from secondary sources. Of the sources used, some are critical evaluations of data while others are simply collections of data. However, even for the 1993 (second) edition, the sources on which the authors depend are not current. If these "older" sources are still the best reference sources on which to depend, then there should be a strong statement to that effect; perhaps even a comment or two as to the "problem"' with the more recent compilations, handbooks, and the like. This book collects together much information. However, there is no indication as to why certain sources are taken or why an easily available more recent source was not used.

As an example of the content, the atomic properties chapter contains the following information: (1) relative atomic masses, (2) properties of natural isotopes (isotopic abundance tables), (3) properties of radioactive isotopes, (4) electronic configurations of atoms, and (5) ionization energy, electron and proton affinity, and electronegativity. In this last section, ionization energies (for the neutral atom and first two atoms), the electron affinity, the proton affinity, and the electronegativity of 105 elements are listed. There are several gaps in the table, of course, due to the unavailability of the data. The data for this tables come from two sources: the well-known 1974 publication by Gurvich *et al*. on bond dissociation energies and a 1977 translation of a book by Huheey on principles of structure and reactivity. There has been much published since these two books; the work by Lineberger and co-workers (JILA/NIST) on electron affinities and Martin and co-workers (NIST) on ionization potentials, to name only two sources.

There are no uncertainties provided by the authors with the numeric values in any of the tables. In fact, the available data have been rounded in many cases. As the authors stated, the numbers were rounded within the accuracy necessary for use in practical calculations and estimations. As a result, one cannot be sure of the uncertainty at all.

In summary, this handbook pulls much information together and forms a single source which might be useful to the individual scientist for nonprecise information. However, the source of the data is not the primary literature, but other secondary sources. Unfortunately, these sources are not as current as they could be, nor is there any indication as to the source of the data being based on a critical evaluation, an estimation (calculation), or a collection of data.

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Physical Quantities and the Units of the International System. By Kuzman Raznjevic. Begel House Inc., New York and Wallingford. 1995. 254 pp. $65.00. ISBN 1-56700-047-9.

It is my belief that a vital first step to understanding modern quantitative science is to become familiar with (i) the notation and symbols used to represent the values of physical quantities, (ii) the concept of quantity calculus (in which a quantity is represented as the product of a number and a unit), and thus the difference between quantities and units, and (iii) the systems of units currently used to represent the values of physical quantities, and in particular the International System of units (the SI). This whole subject has been well described by McGlashan as "the grammar and spelling of science", and it is as important for science as are grammar and spelling themselves for the study of literature. These aspects of modern science are seldom taught in any systematic way; students generally being left to pick it up as they go along. Teachers are just beginning to realize the importance of this subject, and the teaching of science is beginning to benefit.

This book is concerned with precisely this subject, and I was therefore expecting to welcome it. However, I am disappointed. It is not a bad book, but it falls a long way short of what I had hoped for. In the first place it is full of redundant material: the useful contents of this book could have been written in less than 100 pages instead of 250, with a corresponding reduction in cost and increased usefulness. Unnecessary verbosity is a hindrance to the reader of today, who is invariably pressed for time. Secondly, it is not well written. Even the author's command of the English language leaves much to be desired. There are many passages in the book whose meaning is lost on me. Thirdly, it contains many small errors, in a subject in which it is most important to present the material free from errors. Finally, although there is a list of references at the end, they are incomplete and in many cases out of date. I believe a book on this subject should carefully reference the sources of authority. In my view this book is poor value for money. I cannot really imagine a student spending $65 this way, and if he did I doubt that he would find the reward that he deserves.

Space prevents me form quoting more than a few examples of these failings, but here are some. As examples of redundant pages, there are more than 50 pages of tables of conversion factors. In the age of the pocket calculator who needs pages of tables to convert degrees Fahrenheit to degrees Celcius, complete with a table of interpolation factors? Even as a schoolboy I learned the rule "subtract 32, and multiply by (5/9)". This comment applies to almost every table of conversion factors in the book. And what is the point of introducing, and giving worked examples using, so many long outdated units, such as the kilopond or the metric horse power or the kilogram-force. The modern student is hardly likely to meet such units; they are really

just a distraction to the objective of the book. As an example of turgid English, I can only suggest that one read the opening five pages of the book; in many cases the meaning is obscure. As examples of errors, the correct use of italic font for quantity symbols and a Roman (upright) font for units, mathematical operators, and mnemonic labels is important, but they are frequently incorrectly used. The author often labors his own ideosyncratic ideas, such as that "dimensionless quantity" is a misleading name and should be replaced by "numerical quantity", where commonly accepted practice would certainly favor the former term; or that the word "per" should not be used with the meaning "divided by" (which is in fact precisely what the word *per* does mean in a technical scientific sense). As examples of inadequate references, there appear to be no text references whatever to the the two pages of references at the back of the book, and the latter are often out of date and inadequate to the extent that the reader would find it impossible to locate them (the SI Brochure, for example, which is the defining publication of the International System of Units, is listed without a publisher or indeed any indication of how to find it other than its title and is dated 1985 where the current edition is 1991). To sum up, I recommend giving this book a miss.

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Physical Chemistry of Aqueous Systems: Meeting the Needs of Industry. Proceedings of the 12th International Conference on the Properties of Water and Steam. Edited by H. J. White, Jr., J. V. Sengers, D. B. Neumann, and J. C. Bellows. Begell House: New York. 1995. 875 pp. $125.00. ISBN 1-56700-034-7.

This book is a collection of 104 papers from the 12th International Conference on the Properties of Water and Steam which was held in Orlando, FL, September 11−16, 1994. This continuing Conference arose from the requirement for understanding and formulating the physical and chemical properties of substances related to the operation of steam power cycles. This need led (at the 7th Conference) to the establishment of the International Association for the Properties of Steam which is now known as the International Association for the Properties of Water and Steam (IAPWS), under whose auspices this Conference is held approximately every 5 years. The interesting history of these conferences is given both in the Introduction and in the plenary lecture by Dr. J. M. H. Levelt Sengers.

The book is organized into twelve sections: plenary lectures; thermophysical properties; calculations of water and steam properties for industrial use; molecular modeling of aqueous systems; metastable steam and nucleation; supercooled, superheated, and stretched water; high-temperature measurement techniques; frontiers of physical chemistry of aqueous solutions; hydrothermal oxidation; chemical processes in steam cycles; plant cycle chemistry; and alternative power cycles. This book also contains an Appendix (185 pp) that contains the "Releases and Guidelines" of IAPWS. The inclusion of this Appendix was an excellent decision on the part of the editors who also did a very good job in maintaining a nice appearance to a book where it appears that most, if not all, of the contributions were prepared as camera ready copy.

Several of the contributions in this book are essential reading for those concerned with the equation of state of water and steam. This reviewer was particularly interested in Hill's view that "an integrated industrial and scientific calculation program can be provided for determining the thermodynamic properties of liquid and vapor H_2O". There are also contributions that deal with new metrological quality measurements of the density and the static dielectric constant of water.

However, practical problems in power generation and in boiler chemistry require data for (water + solute) systems in addition to pure water. Here, the problems faced in corrosion, pollution abatement, and feedwater conditioning lead one into studies in aqueous solutions at high temperatures and pressures. This is an area of research that has seen a substantial increase in activity since the early pioneering work of individuals such as Marshall and Franck. We now have a significant data base that has been developed over a period of many years and is based on contributions from many laboratories. Particularly impressive is the continuing effort carried out at Oak Ridge National Laboratory, which is described in several contributions in this book. There are also contributions that deal with the use of the data in modeling programs that can be used for engineering calculations.

Many contributions deal with practical problems in power plant technology, boilers, metallurgy, pollution control, corrosion, and speculation on the future of electric power generation. Although the majority of the contributions is concerned with experimental aspects of this general area of research, there are also theoretical papers on topics such as molecular modeling calculations applied to aqueous systems. As is the case with any Conference Proceedings, there are contributions that are truly excellent as well as some that have very little information content. However, this reviewer finds this book to be substantially above the average of the typical Conference Proceedings. The Conference also did an excellent job in bringing research scientists and representatives of industry together. In summary, this is a book that is recommended to all those interested in water, in aqueous solutions at high temperatures and pressures, and in the practical applications of these systems.

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