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Book Reviews

Handbook of Radiochemical Exercises. By An. N. Nesmeyanov, V. I. Baranov, K. B. Zaborenko, N. P. Rudenko, and Yu. A. Priselkov. Translated from Russian by E. Kloczko, translation edited by R. W. Clarke. Pergamon Press, New York (1965). 448 pp. $12.00.

It is difficult to determine from examining this book what it represents in terms of the scientific level of Russian radiochemistry. The work itself is a more-or-less standard approach to the teaching of radiochemical techniques in that it includes sections of text material and practical exercises. The five major headings include "Equipment for Radiochemical Laboratories," "Nuclear Radiation and Methods for its Measurement," "Decay and Growth of Radioactive Isotopes," "Production and Properties of Radioactive Isotopes," and "Applications of Radioactive Isotopes as 'Labelled Atoms'." The practical exercises include descriptions of 89 experiments to be performed by users of the book, although the preface outlines suggested sequences of experiments to be followed by special interest groups. Thirteen appendixes are included with lists of reagents, apparatus, protective clothing, decay curves, exponential functions, and tables of multiples of 16 and 64.

It is the last two appendixes that give a clue as to the level of sophistication of the book, since scales of 16 and even 64 are rarely seen in Western counting rooms. Actually, the tone of the entire book is suggestive of pre-World War II radiochemistry. There do not appear to be any significant references to original papers dated later than 1950, and the majority of references are to Russian literature between 1935 and 1939. There are a few references to various collections of non-Russian papers published in Russian in 1952-54. The only non-Russian textbook in radiochemistry referred to is the first edition of Friedlander and Kennedy, which apparently was translated into Russian in 1952.

It is uncertain whether this time lag represents the difficulties in Russian translation of English works, whether it represents the time lag in English translations of contemporary Russian volumes, or whether it represents the equipment and techniques actually used in the contemporary Russian academic community. If the last is the case, it is evident that a great amount of scientific exchange is still needed.

It is hard to evaluate the equipment used in the same way. Educators in the United States have excellent budgets for apparatus when compared to that available in many other countries. However, the selection of equipment described and of the apparatus used in the experiments is considerably out of date by our standards. About 25 pages include descriptions and operating instructions for electrometers—string, quadrant, Compton, "binant," and torsion types. Some nine pages are devoted to gas counters, although three lines suffice to distinguish proportional and Geiger-Müller counters. One page each covers crystal counters and photomultiplier tubes. Nine lines are used to describe a spinthariscope, and 20 lines are devoted to scintillation counters. A group of excellent autoradiograms are included in the several pages describing this technique.

The extensive group of practical exercises include some interesting experiments, in addition to many of the standard variety. Many of these experiments make use of natural radioactive materials, although some 20 of them employ radioisotopes, such as ^{32}P and ^{24}Na.

The text material in the early sections of the book suffers from a very strong aura of inaccuracy and lack of precision. Again, this may be a translational problem, but reference to "radioactive radiation," the roentgen as a unit of absorbed dose, the use of "rutherford" for disintegration rate, etc. suggest questions as to how closely this book represents what is actually being taught to contemporary Russian students.

In summary, this is not a book that would have a significant place on the bookshelf of a working scientist in the West. If the reader is interested in comparative studies of scientific educational approaches, it is a most interesting example. If this book represents an actual example of cultural and scientific insulation, let us hope for an era of free interchange of scientific information throughout the world.

Ralph T. Overman

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February 15, 1966

About the Reviewer: An early worker in the radioisotope and radiation field, Dr. Ralph T. Overman has been active in a variety of research and educational activities in the nuclear field. He was associated with the thermal diffusion uranium separation project and the Oak Ridge National Laboratories during and after World War II and in 1948 established the Training Division of the Oak Ridge Institute of Nuclear Studies. In that position, he was responsible for training nearly 6000 scientists and educators in radioactive techniques until his resignation from the Institute in 1965. He now heads his own consulting firm in Oak Ridge, Tenn. He is a Fellow of the American Nuclear Society and has published two books in the field of radioactivity and experimental radiochemistry.

Refractory Ceramics for Aerospace. By J. R. Hague et al. The American Ceramics Society, Inc. Compiled by Battelle Memorial Institute (1964). $8.00.

This handbook, in spiral-bound notebook form, contains thermal and mechanical data on approximately 600 compounds with melting temperatures above 3000°F. The main body of the work is divided into sections of some 50 pages each, on borides, carbides, nitrides, single oxides, "mixed oxides" (i.e., silicates, aluminates, etc.), plus shorter sections on sulfides and various intermetallics. Within these sections, the compounds of cations from the same column of the periodic table are considered together. As a typical example, a seven-page section is devoted to VC, V_2C, NbC, Nb_2C, TaC, and Ta_2C. The first page contains a table listing the crystal structure (but not the cell dimensions), the theoretical density, and the melting point of the six compounds. There is a table of the mean linear coefficients of thermal expansion over various ranges and of various mechanical properties at room temperature. About a dozen graphs presenting various thermal and mechanical properties as a function of temperature are included also. A single graph may show several different curves, with data from different references, or a range of values shown by shading an area on the graph. The source of each piece of data is given by a reference number, which directs the reader to a list of 618 references at the end of the work. Also, in the immediate vicinity of the data, there is a capsule review of the experimental details.

In addition, at the beginning of the work and at the beginning of each section, there are attempts to generalize the properties of the compounds of a given anion. A general range of the values covered by the various measured properties is given for each group, and compared among groups; the occasional compounds that fall outside the ranges are given as exceptions. This is useful, not only to give the reader an overall view of the properties and to permit him to eliminate a search through blocks of unproductive data, but also to enable him to make a ballpark estimate when a particular piece of data is missing.

The authors are unusually candid about missing data. A table shows, by x, the information available about each compound, and the gaping arrays of boxes without an x bear witness to what was not found. The authors make the astute observation that the well-characterized substances are those most likely to be available as well-controlled material in the market place.

However, there are some grounds for criticism. With a few exceptions, such as stabilized zirconia, only pure stoichiometric compounds are covered. It is perhaps true that any attempt to cover solid solutions would result in an unwieldly work, largely out of date by the time it was published. But it is also true that every additional component offers the designer another degree of freedom in the selection of a material. We cannot expect complete charts of the variations of properties with composition in every possible solid solution, but it would be useful to have some indication as to what substances can be dissolved, together with some generalizations such that, given the properties of the end members, a reasonable estimate of the properties of intermediate compositions could be made.

Silicates, aluminates, and other compounds of two cations with oxygen are lumped together as "mixed oxides." This is an error. Silicates are clearly a distinct group; the bonding between the SiO_4^{-4} tetrahedra permit crystal structures greatly different from those of a typical oxide. Furthermore, the compositions are given in the dot-type formulae rather than structural formulae: $MgO \cdot SiO_2$ instead of $Mg\,SiO_3$. As a result, we are not encouraged to recognize that $Mg\,SiO_3$ is one of a group of compounds with silica tetrahedra linked in $SiO_3^{=}$ chains. Likewise, no attempt is made to point out the relationships between the very characteristic group of spinels, the cubic $A\,B_2\,O_4$ compounds. $Fe\,Al_2O_4$ is listed under the aluminates as $FeO \cdot Al_2O_3$; magnetite, $Fe\,Fe_2O_4$, is listed as the "simple oxide" Fe_3O_4; and $Mg\,Fe_2O_4$ is listed in still another place as the "ferrite" $MgO \cdot Fe_2O_3$. No notice is taken of the rather similar physical properties of these materials.

If zircon $ZrSiO_4$ had been recognized as a typical SiO_4^{-4} compound, with isolated SiO_4 tetrahedra, its formula would not have been written mistakenly as $ZrO \cdot SiO_2$ on pages 25, 279, and 281. It is also interesting to note that the Table on page 285 distinguishes carefully between "cubic" and "isometric," listing some compounds as one, some as the other.

Nevertheless, there is a place on our shelves for this volume and others like it. In present-day technology, we need summaries and compendia, arranged so that we can find a necessary fact in a hurry. These compendia should serve the purpose of eliminating superseded, irrelevant, or obviously inferior data, and converting the remainder into compatible units. They should be bound in soft covers, with a plastic spiral binding, to remind us of the perishability of data; and, when the next edition comes out, they can be discarded.

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March 17, 1966

About the Reviewer: Dr. Berman received his training in mineralogy at Harvard. After a number of years with the US Geological Survey, during which he worked largely on radioactive minerals, he joined the staff of Bettis Atomic Power Laboratory. His studies have been concerned with UO_2 and its solid solutions, as well as other reactor materials, had have covered such matters as phase change kinetics under irradiation, the effect and disposition of fission products, and solid solution between the compounds.

Thermodynamic Cycles of Nuclear Power Stations. By D. D. Kalafati. (Translated from the Russian by the Israel Program for Scientific Translations.) Daniel Davey & Company, Inc., New York (1965). 194 pp. $14.00.

The purpose of this book is to discuss the interrelation between the reactor design criteria, particularly the influence of fuel cladding temperature limitations, and the steam cycle parameters. Although it will be of interest to all concerned with the optimisation of overall reactor-turbine cycles, it should appeal principally to those concerned with the determination of the turbine cycle conditions.

The early chapters deal with the reactor design parameters. Two chapters follow on the thermodynamic analysis of steam generator, condenser, and feedwater heater design. The following chapters deal in turn with the thermodynamic cycles for water-cooled, organic, liquid-metal, and gas-cooled reactors. The final chapter covers the question of optimum power consumption for coolant recycling.

For water- and gas-cooled reactors, the magnitude and effect of irreversibility losses in the complete reactor-turbine cycle are discussed in some detail.

The principal omission in the book is the tendency to overemphasize the theoretical analysis at the expense of practical design considerations. For example, the equations for optimum heat-exchanger surface are inapplicable