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 It is perhaps true that any attempt to cover solid solutions would result in an unwieldly work, largely out of date by the time it was published.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 to a heavy-water-cooled and -moderated reactor where one of the key design parameters is the value of the heavy water holdup. The practical advantages of steam reheating in the turbine cycle are not fully discussed. The lower low-pressure turbine exhaust moisture with reheat should give longer last-row blade life; however, the ability it confers on the turbine manufacturer to use standard low-pressure turbine sections by matching steam-inlet conditions for the L. P. turbine to those prevailing on conventional sets is of even greater importance.

The treatment of annual fixed charge rate on the capital invested is one area that causes some confusion. Two fractions are used, one called the investment charge and the other the normative effectiveness coefficient. These two fractions are added together to obtain the total annual charges on capital. It would appear that the investment charge is equivalent to interest rate and that the normative effectiveness coefficient is equivalent to depreciation plus taxes. A figure of $12\frac{1}{2}\%$ is quoted in the text for this coefficient; this appears to be very high compared to European or North American practice. However, it is a simple matter to substitute one's own figures for annual charge rate, although this, of course, will modify the conclusions as regards those optimum parameters that are cost dependent.

The book is noteworthy for its comprehensive treatment of a wide range of steam cycles including triple-pressure cycles, binary and supercritical cycles for use with organic coolants, and compound cycles such as the Field cycle about which little has been heard in recent years. The text also touches on various possible MHD cycles.

The translation is of good quality, only very rarely does any confusion arise. On page 152, reference is made to a mercury-cooled boiling-water reactor, whereas the context makes it clear that the reference should be to a boiling-mercury reactor. Although the chapter headings in the Table of Contents are broken down into subheadings, there is no index as such. The list of symbols used in the text, although extensive, is not complete and this does necessitate some hunting around to find the first reference in the text to the unlisted symbol.

These criticisms are of a minor nature compared to the overall value of such a comprehensive text on a topic that, for its importance, has hitherto received little published attention except in the form of scattered papers.

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March 10, 1966

About the Reviewer: Alan Wyatt received his graduate and postgraduate engineering training in England's Royal Navy. Since 1957, he has been principally in Canada, where in 1958-59 he developed the steam cycle used for the CANDU heavy-water reactors. During 1961, he worked in England on various cycles, including flashed steam and compound cycles, for gas-cooled and marine pressurized-water reactor studies. He is at present Proposals Engineer in the Power Projects Division of Atomic Energy of Canada Limited. Recently, he completed the steam-cycle studies for the 250-MW(e) heavy-water-moderated, boiling-light-water-cooled reactor proposed for Quebec. He is the author of a number of papers on various aspects of steam-cycle analysis, and he has lectured at the University of Toronto on thermodynamics for heavy-water power reactors.

Boiling Heat Transfer and Two-Phase Flow. By L. S. Tong. John Wiley and Sons, Inc., New York (1965). 216 pp. $14.00.

Due to the increasing necessity for advanced concepts and technologies in the nuclear and space industries, numerous studies have been, and will continue to be, reported on the subject of boiling heat transfer and two-phase flow. Significant contributions can be found in a wide variety of domestic and foreign journals, laboratory reports, technical progress reports, etc. Consequently, attempting to understand and keep up to date on progress in two-phase flow technology can often be a disconcerting and enormous task for engineers. The appearance of *Boiling Heat Transfer and Two-Phase Flow*, the first textbook to cover the general field, should greatly ease this task.

"The objectives of this book," Tong writes, are:

"1. To provide colleges and universities with a textbook that describes the present state of knowledge about boiling heat transfer and two-phase flow.

2. To provide research workers with a concise handbook that summarizes literature surveys in the field.

3. To provide designers with useful correlations by comparing such correlations with existing data and presenting correlation uncertainties whenever possible."

In the reviewer's opinion, the author has fulfilled all three objectives. He presents a most difficult subject, of which much of the material is inevitably semi-empirical in a clear and logical manner, always maintaining a sound engineering perspective. My only regret is the lack of any specific illustrations and the failure to include any problems.

The material in this book covers parts of a graduate course given by the author at the Carnegie Institute of Technology, Pittsburgh.

In the first chapter, definitions of boiling regimes, two-phase flow, boiling crisis, and flow instability are established. In the second chapter, pool boiling is described, including nucleation and dynamics of single bubbles, hydrodynamics of the boiling process, and pool-boiling heat transfer. Correlations of nucleate, transition and film-boiling data of water, organic fluids as well as liquid metals are presented. The third chapter is devoted especially to the hydrodynamics of two-phase flow, in particular, the flow pattern, the void fraction, and the velocity ratio. A discussion of phase, velocity, and shear distribution in various flow patterns is also included. Closely related to the flow pattern is the two-phase pressure drop, the topic of the next chapter. Here, a summary is given of available analytical and empirical models for calculating two-phase pressure drops in ducts as well as over-abrupt expansions and contractions. The chapter ends with a discussion on two-phase critical flow.

Chapter 5 introduces flow boiling. Here, nucleate boiling in flow, forced-convection vaporization and film boiling, and heat transfer in the liquid-deficient region are elaborated. The last two chapters in the book emphasize the boiling crisis and flow instability. Chapter 6 on flow boiling crisis summarizes theoretical, as well as empirical, approaches to the problem of "burnout." Designers are provided with practical correlations, and a discussion of parameter effects of flow boiling is included. The last chapter of the book treats the problem of instability, both from a hydrodynamic and thermohydrodynamic point of view. The basic thermohydrodynamic equations are pre-