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A CONTINUING SYSTEMATIC PROGRAM ON TABLES OF THERMOPHYSICAL PROPERTIES OF MATERIALS

C. Y. HO

Thermophysical Properties Research Center
Purdue University

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FOREWORD

This report was prepared by the Thermophysical Properties Research Center (TPRC), Purdue University, West Lafayette, Indiana, under USAF Contract No. F33615-68-1229, "Scientific Documentation and Preparation of Data Tables on Thermophysical Properties." This continuing program is performed under Project No. 8975, Materials Information Analysis Center, Task No. 897502, Thermophysical Properties Research Center. The work was administered under the direction of the Air Force Materials Laboratory, Air Force Systems Command, Wright-Patterson Air Force Base, Ohio, with Mr. John H. Charlesworth (MAAM) acting as Air Force project engineer.

This report covers work conducted from 1 January 1969 to 31 December 1969. Dr. Y. S. Touloukian has been the principal investigator and program director. The report was submitted by the author in March 1970.

All the staff of TPRC's Administration, Data Tables Division, Scientific Documentation Division, Engineering Graphics Unit, and Technical Typing Unit have contributed to this program. In particular, the following members of TPRC's professional staff have contributed greatly to the respective projects: Dr. R. W. Powell (senior investigator), Mr. K. Y. Wu, and Mrs. E. K. C. Lee to the tables of thermal conductivity of solids; Dr. P. E. Liley (senior investigator) to the tables of thermal conductivity of fluids; Dr. T. Makita (senior investigator), Dr. Y. Tanaka, Mr. K. Ueda, Miss K. Inoue, and Miss E. Hata to the tables of specific heat of fluids; Dr. D. P. DeWitt (senior investigator), Mr. M. C. Muinzer, Mr. R. S. Hernicz, Dr. J. J. Hsia, Mrs. S. L. Miller, and Mr. K. F. Sohn to the tables of thermal radiative properties; Dr. M. C. Nicolaou (senior investigator) to the tables of thermal diffusivity; Dr. P. Hestermans (senior investigator) and Dr. S. C. Saxena (senior investigator) to the tables of viscosity; Dr. R. E. Taylor (senior investigator), Mr. P. L. Wang, Mr. B. M. Whitcomb, Mr. S. N. Vo, and Mr. M. Nalbantyan to the tables of thermal expansion; Mr. W. H. Shafer to the technical inquiry services; Prof. F. E. Davis to the computerized information storage and retrieval; Mrs. J. K. Gerritsen, Mrs. N. Y. Moore, Mrs. B. M. Schick, Mrs. C. A. Pelikan, Mrs. V. Ramdas, Mr. G. Kvakovszky, Mrs. S. A. O'Kane, Mrs. K. Singleton, and Mrs. M. R. Troyer to the extensive documentary work so necessary to make the tables projects possible.

This technical report has been reviewed and is approved.

Edward Dugger

EDWARD DUGGER, Chief
Materials Information Branch
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ABSTRACT

This technical report covers work in a continuing systematic program on the thermophysical properties of materials involving the literature search, acquisition, codification, and organization, and data extraction, compilation, evaluation, correlation, analysis, and synthesis, the preparation of "intermediate tables" presenting the total available experimental information, and the final preparation of internally consistent tables of "best data" referred to as "Tables of Recommended Reference Values." The work reported on consists of both data tables projects and scientific documentation efforts. The data tables projects are on the thermal conductivity, specific heat, thermal radiative properties (emittance, reflectance, absorptance, transmittance), thermal diffusivity, and thermal linear and volumetric expansion of elements, ferrous and nonferrous alloys, intermetallic, semiconducting, and nonmetallic compounds, cermets, ceramics, mixtures, composites, systems, polymers, etc., and on the thermal conductivity, specific heat, and viscosity of fluids and fluid mixtures. Property data are presented in both tabular and graphical forms, with accompanying tables giving specifications and characterizations of the test specimens for the data. The resulting data tables are disseminated at large though the 13-volume TPRC DATA SERIES published commercially. This report does not contain the completed thousands of data sheets, but does reproduce in the Appendix, the Table of Contents and the Grouping of Materials and List of Figures and Tables for each of the first seven volumes (which contain over 8000 pages) of the TPRC DATA SERIES to show the scope of their coverage. In scientific documentation, the scope is broader. TPRC covers all materials and maintains cognizance over sixteen thermophysical properties (six more than mentioned above). There are now 55 700 references in TPRC's automated Information Storage and Retrieval System. The resulting information on research literature is disseminated through the THERMOPHYSICAL PROPERTIES RESEARCH LITERATURE RETRIEVAL GUIDE, published commercially.

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SECTION I

INTRODUCTION

The knowledge of the properties of materials is of great importance in modern science and engineering. The present obstacles and limitations in many technological developments are often a direct result of the paucity of knowledge of the properties of materials. The ever increasing amount of activities in property determinations in recent years attests to the seriousness of the situation with the result that the volume of research literature has increased many fold. Despite the widespread efforts, the present level of research on thermophysical properties of materials still falls short of existing needs and anticipated future demands. However, what is even more disturbing is the fact that engineers across the nation are using no more than a small fraction of the information already existent, either because its existence is not generally known to them or because it is in a form not directly usable, and such information remains buried in the world's technical literature.

The Thermophysical Properties Research Center (TPRC) has been pioneering to provide a remedy to this disturbing situation by conducting a continuing systematic program for more than a decade to dig the buried treasures out of the world's enormous volume of literature and put them in a form directly useful to engineers and scientists at large. This program on the thermophysical properties of materials involves the literature search, acquisition, codification, and organization, and data extraction, compilation, evaluation, correlation, analysis, and synthesis, the preparation of "intermediate tables" presenting the total available experimental information, and the final preparation of internally consistent tables of "best data" referred to as "Table of Recommended Reference Values."

The data tables projects of this program include the thermal conductivity, specific heat, thermal radiative properties (emittance, reflectance, absorptance, transmittance), thermal diffusivity, and thermal linear and volumetric expansion of elements, ferrous and nonferrous alloys, intermetallic, semiconducting, and nonmetallic compounds, cermets, ceramics, composites, mixtures, systems, polymers, etc., and the thermal conductivity, specific heat, and viscosity of fluids and fluid mixtures. Property data are presented in both tabular and graphical forms, with accompanying tables giving specifications and characterizations of the test specimens for the data. The resulting data tables are disseminated at large through the 13-volume TPRC DATA SERIES published commercially.

In scientific documentation, the scope is broader. TPRC covers all materials and maintains cognizance over the following sixteen thermophysical properties: thermal conductivity, accommodation coefficient, thermal contact resistance, thermal diffusivity, specific heat, viscosity, emittance, reflectance, absorptance, transmittance, absorptance to emittance ratio, Prandt number, diffusion coefficient, thermal linear expansion coefficient, thermal volumetric expansion coefficient, and surface tension. The resulting information on research literature is disseminated through the THERMOPHYSICAL PROPERTIES RESEARCH LITERATURE RETRIEVAL GUIDE, published commercially.

The overall activities of TPRC are divided into four areas: namely, (1) Scientific Documentation, (2) Generation of Data Tables, (3) Experimental Research, and (4) Theoretical Research. The activities discussed in this report cover the first two areas.

The literature search, information processing, and data processing for preparing the Retrieval Guide and the TPRC Data Series and the status of the various active projects are outlined in the following sections. It should be noted that part of the projects discussed below are not funded under this contract.

SECTION II

SCIENTIFIC DOCUMENTATION

1. LITERATURE SEARCH AND INFORMATION PROCESSING

The Scientific Documentation Division of TPRC provides comprehensive and authoritative source information on the thermophysical properties of all matter through continuing and systematic literature search, acquisition, codification, and organization of the existing information in the world literature, and putting the information in TPRC's automated Information Storage and Retrieval System.

From 1957 to 1964 TPRC has searched the world literature primarily through sixteen abstracting journals. This search, covering the publication period from January 1920 to June 1964, has involved the scanning of approximately 33 400 000 abstracts out of approximately 81 000 000 abstracts reported by these journals. Out of the 33 400 000 abstracts scanned, only 52 500 (0.16%) were considered pertinent. Subsequent examination and checking of the 52 500 abstracts and the original papers revealed a large number of duplications between the various abstracting journals and nearly 9900 irrelevant ones, leaving a net total of 28 800

research documents obtained from these sources. In addition to abstracts, 4900 documents had come to TPRC's attention from other sources making a total of 33 700 documents up to June 1964. These 33 700 references are covered in the revised second edition of the Retrieval Guide published in October 1967.

Subsequently, in preparation for future Retrieval Guide publications, an additional 22 000 reference entries have been made. Thus, as of 31 December 1969 there are 55 700 references identified for TPRC's Information Storage and Retrieval System. The above figures give an insight as to the magnitude of the effort involved in a thorough search of world knowledge even in a relatively specialized field. The overall current statistical data for TPRC's scientific documentation are presented in Table I.

When the retrospective search of the world literature, primarily through the medium of abstracting journals, was completed early in 1965, TPRC reviewed its procedure of using abstracting journals for the identification of current literature on thermophysical properties research. It was recognized that continued use of abstracting journals for research awareness would represent, at best, one to two years delay in identifying and procuring such literature, with the result that bibliographic searches provided by TPRC could not be on a reasonably current basis. Hence, beginning in 1965 TPRC has subscribed to some 80 highly selected scientific and technical journals to obtain current research articles. To complete the literature search, the Chemical Abstracts continue to be scanned to cover the open literature and several government abstracting journals such as the Scientific and Technical Aerospace Reports, U. S. Government Research and Development Reports, etc. are scanned to cover the government report literature. In addition to these basic sources, TPRC searches certain specialized sources such as Masters Theses in the Pure and Applied Sciences, Doctoral Dissertation Abstracts, and a number of special compendia. Of particular note here are the two overseas Branches of TPRC at Brussels, Belgium, and Kobe, Japan, who serve a very important input function for European and Far Eastern literature*. Furthermore, TPRC continues to develop its cooperative working arrangements on the exchange of research results and scientific information with major national and international institutions engaged in thermophysical properties research. As a result of this policy, TPRC is now able to keep abreast of current research with an average time

*These TPRC overseas Branches are not supported under this contract.

TABLE I. STATISTICAL SUMMARY OF SCIENTIFIC DOCUMENTATION ACCOMPLISHMENTS

(As of 31 December 1969)

	In 1969	Total at End
Documents identified	4 261	55 700
Documents received	10 747	56 628
Documents coded	6 605	47 651
Reference entries on all properties	16 804	183 135

Reference Entries by Property
(Since publication of Retrieval Guide, 2nd edition)

	Reference Entries (In 1969)	Reference Entries (Total at End)	% of File (At End)
Thermal conductivity	3 371	8 989	20.51
Specific heat	2 389	6 299	14.37
Diffusion coefficient	1 385	4 905	11.19
Viscosity	1 848	4 731	10.79
Thermal linear expansion coefficient	2 526	4 202	9.59
Reflectance	1 307	3 511	8.01
Surface tension	1 252	3 205	7.31
Transmittance	875	3 067	7.00
Emittance	481	1 470	3.35
Absorptance	347	1 133	2.59
Thermal diffusivity	302	841	1.92
Thermal volumetric expansion coefficient	200	593	1.35
Accommodation coefficient	241	374	0.85
Thermal contact resistance	192	282	0.64
Prandtl number	73	146	0.33
Absorptance to emittance ratio	15	82	0.19
Total	16 804	43 830*	100%

*There are 139 305 reference entries (see Table II) in Book 2 of Retrieval Guide, 2nd Edition, making a grand total of 183 135 reference entries as of 31 December 1969.

lag from document publication to acquisition not to exceed six months. Besides being used as input to the Data Tables Projects at TPRC, the information acquired under the documentary phase of this program is intended to render technical inquiry services to governmental, industrial, and academic laboratories in answering questions on thermophysical properties.

A statistical study completed in late 1968 showed that some 330 of the total over 3600 scientific and technical journals cited to date yielded more than 85 percent of the articles. The top-yielding 50 journals subscribed by TPRC plus all the government reports, Ph.D. dissertations, and masters theses received by TPRC yielded over 60 percent of the current holdings.

It would be desirable to replace the manual literature searching and scanning by computer searching and scanning if it could be workable so as to reduce the time lag in document identification. However, it was found that, due to the prevailing inaccurate assignment of key words to articles, the computer could pick out less than 50 percent of the pertinent articles from the literature and the other 50 percent or more would be lost. Furthermore, the majority of the articles picked out by the computer would still have to be screened manually for being valid and useful for the documentation file. In view of the above, it appears that manual processing must continue for document identification and screening.

The problem of procuring research documents from the open literature is beginning to assume major proportions especially in the case of foreign literature and special publications of limited distribution. Therefore, TPRC's specialized holdings constitute a unique national asset and are assuming increasing importance for rapid access to the world literature on thermophysics and thermophysical properties. It is TPRC's experience that literature retrieval programs which yield only bibliographies as their end product are becoming increasingly less useful because of the time lapse involved in procuring the cited documents. To remedy this situation, TPRC has supplemented its long-standing practice of submitting bibliographic responses to literature search requests with copies of the actual documents in the form of standard microfiche. The conversion of TPRC's hard copy document holdings into microfiche form was completed during 1967.

2. RETRIEVAL GUIDE

The comprehensive second edition of the THERMOPHYSICAL PROPERTIES RESEARCH LITERATURE RETRIEVAL GUIDE was published in October 1967 by the Plenum Press.

This three-book volume represents the printout of a special computer program and provides quick access to the world literature on thirteen thermophysical properties of all matter. This definitive work contains a complete coverage of the world literature published from January 1920 (in some cases earlier) to June 1964 on thirteen thermophysical properties. Its 2800 pages (in 3 books) report 45 116 materials, citing 33 700 references representing 26 562 authors and 3600 separate scientific and technical journals and books in addition to Government reports. Its substance and property coverages are listed in Table II. The contents of the three books of the Retrieval Guide are as follows:

Book 1: Primarily constitutes TPRC's classified Directory of Substances in which information on the thirteen thermophysical properties are reported. Book 1 also contains three other major chapters which greatly enhance its usefulness. These consist of: (1) Guide to TPRC's Substance Classification Procedure and Numerical Codes; (2) Dictionary of Synonyms and Trade Names with a Listing of Cross References; and (3) Index to Mixtures.

Book 2: Contains the classified code entries and publication year of each reference for each property of each material. The classified code entries cover the following:

Phys. State:	1-Solid; 2-Liquid; 3-Gas; 4-Semi-solid; 5-Powder; 6-Suspensoid; 7-Sintered; 8-Solid-Gas system; 9-Solid-Liquid system.
Subject:	1-Theoretical; 2-Experimental; 3-Theo. and Exp.; 4-Property values; 5-Theo. and Prop. val.; 6-Exp. and Prop. val.; 7-Theo., Exp., and Prop. val.; 8-Survey, Review, Compendia, or Bibliography.
Language:	1-Eng.; 2-Fr.; 3-Ger.; 4-Dutch; 5-It.; 6-Jap.; 7-Rus.; 8-Span.; 9-Other.
Temperature:	1-Low, 0 to 75 K; 2-Normal, 75 to 1275 K; 3-High, 1275 K and up; 4-(Low + Normal); 5-(Normal + High); 6-(Low + Normal + High); 7-Not specific.

Book 3: Part A provides bibliographic citations for the 33 700 references covering scientific and technical journals in addition to university dissertations and

TABLE II. SUBSTANCE AND PROPERTY COVERAGES OF RETRIEVAL GUIDE*

SUBSTANCE COVERAGE - All Matter		PROPERTY COVERAGE - Transport and Thermodynamic Properties Encountered in Heat and Mass Transfer Calculations	
Elements and chemical compounds	9 030	Thermal conductivity (including accommodation coefficient and thermal contact resistance)	31 050
Ferrous and nonferrous alloys	9 970	Specific heat	28 030
Mixtures	13 396	Viscosity (Newtonian and non-Newtonian; including fluidity)	46 870
Systems, composites, etc.	1 643	Thermal radiative properties (emittance, reflectance, absorptance, transmittance, and optical constants)	9 400
Polymers, rubbers, etc.	2 600	Diffusion coefficient	21 720
Refractories	961	Thermal diffusivity	1 705
Glasses	1 109	Prandtl number	540
Natural products	1 100		
Minerals	662		
Paints, surface finishes, coatings	2 632		
Slags, scales, aggregates, cermets, fuels, lubricants, fibers, fabrics, pharmaceuticals, insulations, building materials, residues, etc.	1 967		
General	46		
Total number of substances	45 116	Total number of reference entries	139 305

*This storehouse of information has come from 33 700 references representing 26 562 authors and 3600 separate scientific and technical journals and books in addition to sources of governmental and industrial reports (e.g., Defense Documentation Center, Clearinghouse for Federal Scientific and Technical Information, Atomic Energy Commission, National Aeronautics and Space Administration, research centers, and the like).

technical reports of governmental agencies, industrial organizations, and research centers and laboratories. Part B contains an index to names of contributing authors.

Effective January 1967, the scope of property coverage by TPRC was increased to include the coefficients of linear and volumetric thermal expansion and surface tension. Furthermore, each thermophysical property is coded separately instead of the past practice of coding several related properties in groups. For instance, the thermal conductivity, accommodation coefficient, and thermal contact resistance were formerly all coded under the property thermal conductivity. They are now coded separately as individual properties. Similarly, the five entries under thermal radiative properties are now listed separately as individual properties. Thus, effective since January 1967, TPRC maintains cognizance over sixteen thermophysical properties for all materials. They are:

A. Thermal conductivity
B. Accommodation coefficient
C. Thermal contact resistance
D. Thermal diffusivity
E. Specific heat at constant pressure
F. Viscosity
G. Emittance
H. Reflectance
I. Absorptance
J. Transmittance
K. Absorptance to emittance ratio
L. Prandtl number
M. Diffusion coefficient
N. Thermal linear expansion coefficient
O. Thermal volumetric expansion coefficient
P. Surface tension

The code entries are also revised as follows:

Physical State: A-Solid (including porous); B-Liquid; C-Gas; D-Powder (loose or cold-pressed - including coarser granular particles), for example, sand; E-Sintered (including hot-pressed); F-Suspensoid (including fine emulsions), for example, petroaltum, blood, milk, paint, mud, clay, paste, gel, etc.; G-Powder - fluid system (including coarser granular particles), for example, sand + liquid, fluidized bed, glass spheres suspended in glycerin, etc.; H-Solid - fluid system, for example, contact in gaseous atmosphere, etc.; I-Liquid - gas system.

Subject: A-Theoretical (about properties) - Original theory or a sufficient amount of modification of existing theory. A theoretical discussion. Analytical development for the prediction of results; B-Experimental - Description, discussion or theory about experimental technique or apparatus for the determination of property values; C-Property Values - Calculated or measured data with no theory or experimental techniques discussed. Limited

data compendia, correlations and nomographs are included here; D-Theoretical and Experimental - Combination of codes A and B; E-Theoretical and Property Values - Combination of codes A and C; F-Experimental and Property Values - Combination of codes B and C; G-Theoretical, Experimental and Property Values - Combination of codes A, B and C; H-Survey or Review - Critical or informative survey or review on a broad scale about experimental techniques or theories; I-Data Collections - Compilation of data on a broad scale (critical or uncritical). Handbooks, data books, encyclopedias, etc.

Language: A-Eng.; B-Fr.; C-Ger.; D-Dutch; E-It.; F-Jap.; G-Rus.; H-Span.; I-Other.

Temperature: A-Low ≤-198 C, ≤135 R, ≤-325 F, ≤ 75 K; B-Normal, ≤1000 C, ≤2292 R, ≤1832 F, ≤1273 K; C-High, >1000 C, >2292 R, >1832 F, >1273 K; D-Low + Normal; E-Normal + High; F-Low + Normal + High; G-Undefined.

3. AUTOMATION AND COMPUTERIZED INFORMATION STORAGE AND RETRIEVAL SYSTEM

With the installation of the new CDC 6500 computer facility at Purdue University in summar 1967, TPRC's long needed capability of full mechanization in its search and retrieval operations has been fulfilled. As a result, TPRC now has an automated bibliographic search capability to respond to specific inquiries or to process standing requests for a continuing bibliographic service tailored to meet demands for specific technical profiles of individual engineers, scientists, corporations, laboratories, or governmental agencies.

During 1969, TPRC will continue to generate, quarterly, miniature "Retrieval Guide" for each property in order to serve its own inhouse programs as well as subscribers at nominal costs. For the future, it is considered to generate a series of Retrieval Guides for individual properties for formal publication so as to parallel the property-oriented 13-volume TPRC Data Series.

SECTION III

DATA TABLES PROJECTS

1. DATA PROCESSING PROCEDURES

As a result of the comprehensive search of literature in the scientific documentation phase of this program described above, the original research papers of interest to TPRC are uncovered. These papers are procured, from which the data are extracted, scrutinized, organized, converted to be in uniform units, and homogeneously tabulated and plotted, in the form of "intermediate tables" presenting the total available experimental information, as the first stage toward the preparation of internally consistent tables of "best data" referred to as "Tables of Recommended Reference Values." TPRC senior staff then review this information and give the organized data final critical evaluation. At this second stage, the experimental data are analyzed, correlated, and synthesized. This two-stage data processing is found by TPRC to be the most logical approach lending itself to greater effectiveness in bringing to the user the results of this type of painstaking research in the shortest possible time.

The detailed procedures which TPRC follows in data compilation and in data analysis and synthesis are not necessarily a matter of established routines and do vary from property to property and from one group of materials to another. There are certain principles which must be followed, however. For example, the data should be extracted directly from their original sources to ensure freedom from errors of transcription. The characterization of the test specimen should be specified as clearly as possible so as to fully identify the material tested. Especially for solids, the source of the material, method of fabrication, treatment and heat history of the specimen and the measuring method and conditions should be noted. If a comparative measuring method is used, the material used as comparative standard should be cited. The accuracy and precision of the data reported should be separately denoted. The complete reference to the original work should always be cited with the data. Whenever some of the above criteria cannot be satisfied because of absence of necessary information in the original work, an attempt is made to contact the author, if possible. In the cases where data cannot be adequately evaluated by TPRC due to lack of required information, such data are appropriately "flagged."

TPRC's Gerber Data Point Reader has been in full operation to accurately and speedily read data points off graphs presented in the research literature. Whenever the graph is too small to give accurate readings, an attempt is made to contact the author, if possible, for original data in tabular form.

In connection with its activities in data processing, TPRC has established, through experience, appropriate procedures of operational practice which lend to good organization of work, uniform recording and filing, and other procedures of "good housekeeping," thus assuring ready tractability of original records of processed data as permanent working records for reference at any time in the future.

The procedure in data analysis and synthesis involves critical evaluation of the validity of available data and related information, resolution and reconciliation of disagreements of conflicting data, correlation of data in terms of various affecting parameters (sometimes in reduced form), comparison of the resulting data with theoretical predictions or with results derived from semi-theoretical relationships or from generalized empirical correlations, etc. Furthermore, thermodynamic principles and semi-empirical techniques are employed to fill in gaps and to extrapolate existing data so that the resulting recommended values are internally consistent and cover as wide a range of the controlling parameters as possible.

2. ACTIVE PROJECTS

TPRC data tables projects include the thermal conductivity, specific heat, thermal radiative properties (emittance, reflectance, absorptance, transmittance), thermal diffusivity, and thermal linear and volumetric expansion of elements, ferrous and nonferrous alloys, intermetallic, semiconducting, and nonmetallic compounds, cermets, ceramics, composites, mixtures, systems, polymers, etc., and the thermal conductivity, specific heat, and viscosity of fluids and fluid mixtures. Table III gives a statistical summary of the accomplishments in 1969 of all the data tables projects. Part of the projects are, however, not funded under this contract.

The resulting data tables are to be disseminated at large through the 13-volume TPRC DATA SERIES, as described in more detail later in the next subsection. A summary of the statistical data on the completed Volumes 1 to 7 of the TPRC DATA SERIES is given in Table IV. The property data are presented in both tabular and graphical forms, with accompanying tables giving specifications and characterizations of the test specimens for the data.

TABLE III. STATISTICAL SUMMARY OF ACCOMPLISHMENTS OF ACTIVE DATA TABLES PROJECTS

(As of 31 December 1969)

	In 1969	Total at End
No. of documents processed	6892	16 094
No. of documents accepted as data sources	2259	7 311
No. of materials compiled	1073	5 437
No. of data sets compiled	9642	38 270

TABLE IV. SUMMARY OF STATISTICAL DATA ON VOLUMES 1 TO 7 OF "TPRC DATA SERIES"

		No. of Pages	No. of Materials	No. of Data Sets	No. of References to Data Sources*
Volume 1.	Thermal Conductivity - Metallic Elements and Alloys	1600	892	5539	1013
Volume 2.	Thermal Conductivity - Nonmetallic Solids	1300	812	4627	598
Volume 3.	Thermal Conductivity - Nonmetallic Liquids and Gases	700	170	1505	725
Volume 4.	Specific Heat - Metallic Elements and Alloys	820	322	1186	428
Volume 5.	Specific Heat - Nonmetallic Solids	1730	550	1009	457
Volume 6.	Specific Heat - Nonmetallic Liquids and Gases	380	56	863	595
Volume 7.	Thermal Radiative Properties - Metallic Elements and Alloys	1650	242	5184	371

*These are the references to data sources only, not including those references to the text on the theory, estimation, and measurement of the respective thermophysical properties.

The following brief summaries will serve to characterize each of the data tables projects.

a. Thermal Conductivity

Thermal conductivity constitutes Volumes 1, 2 and 3 of the TPRC DATA SERIES. The data compilation and critical evaluation and the generation of recommended reference values for the thermal conductivity of the elements is totally completed and is being maintained on a current basis. For the other groups of materials the work is finished to various degrees depending upon the importance of the various groups of materials. It has been a standing practice to try to finish the data processing for the most current research documents first and then to work backwards on the older documents of earlier years. Because of the immense amount of new research documents generated every year and because of the limited funding level and man-year effort, it is impossible at the present level of operation to process completely all the research documents for all the materials.

In the Retrieval Guide, second edition, which contains 33 700 references, there are 7329 references on thermal conductivity, i.e., 21.7 percent (neglecting the relatively small number of references on accommodation coefficient and thermal contact resistance). The present rate of document input into TPRC's Information Storage and Retrieval System is about 6000 per year. If the past ratio remains approximately the same, as indicated by the relative file size (20.51%) for thermal conductivity shown in Table I, there are over 1200 new documents per year on thermal conductivity entering TPRC System. Therefore, it becomes a too arduous task even just to maintain current by processing the most recent documents, 1200 per year. A similar situation is present for most of the other projects.

The thermal conductivity of metals, alloys, and intermetallic compounds, which are organized into seven groups, is included in Volume 1 of the TPRC DATA SERIES. Besides the presentation of experimental data, recommended values are given for the elements and for a few alloys. Volume 2 presents data for thirty groups of nonmetallic solids. Recommended values are given for the elements and a few oxides. Volume 3 contains the critically evaluated and recommended reference values for 58 fluids and also the compiled data for 112 systems of gas mixtures which are organized into four groups. The pure fluids are organized into three groups; for the elements recommended values are given for solid, saturated liquid, saturated vapor, and gaseous states while for the other two groups of pure fluids, recommended values are given for saturated liquid and gaseous states. See the Appendix for complete lists of the materials covered.

Since all the three volumes on the thermal conductivity are completed, in addition to updating and upgrading the existing tables and compiling data for new materials, the future efforts will also include the critical analysis of the data for alloys of Volume 1 and refractory oxides of Volume 2 and the extension of the work on Volume 3 to the thermal conductivity of an increasing number of refrigerants and to the high-pressure effect on the thermal conductivity of liquids and gases.

b. Specific Heat

Specific heat constitutes Volumes 4, 5 and 6 of the TPRC DATA SERIES. Tables on the specific heat of the elements and of all the important alloys, intermetallics, compounds, cermets, and mixtures have been prepared. Data on the specific heat of metallic elements and alloys and nonmetallic solids are compiled here at TPRC while the work on nonmetallic liquids and gases is done at TPRC's Kobe Affiliate in Japan.

The specific heat of the metals and alloys, which are organized into four groups, is included in Volume 4. Volume 5 presents data for twenty-four groups of nonmetallic solids. Volume 6 contains the critically evaluated and recommended reference values for 56 fluids organized into four groups, and the recommended values are given for both liquid and gaseous states.

Besides updating and upgrading the existing tables and compiling data for new materials, the future efforts will also include the critical analysis of the data for the elements of Volumes 4 and 5 and the extension of the work on Volume 6 to the specific heat of an increasing number of refrigerants and to the high-pressure effect on the specific heat of liquids and gases.

c. Thermal Radiative Properties (Emittance, Reflectance, Absorptance, and Transmittance)

This group of properties constitutes Volumes 7, 8 and 9 of the TPRC DATA SERIES. The radiative properties of metals and alloys are presented in the completed Volume 7. Volume 8 will contain the data for many groups of nonmetallic solids, while Volume 9 will present the data for coatings of all types, especially those particularly suitable for thermal control and for high temperature applications.

The present tables are organized in a way that is much different from that in the original TPRC Data Book. It is due to the establishment of a better scheme for the designation and categorization of the subproperties. According to the new scheme, by applying the proper geometric conditions (angular, normal, hemispherical) and

wavelength conditions (spectral, total, integrated, solar) to the four prime properties, there are althogether thirty-three subproperties for any one material. The wavelength range covers from 500 Å to 1000 μm, which encompasses the thermal portion of the spectrum, and special attention is given to solar spectrum conditions.

In addition to the presentation of original data, the data for many materials have been analyzed and "analyzed data graphs" are presented in parallel to give the user an evaluated review of the available data and where possible to recommend values under specific environmental conditions.

Since Volume 7 is now completed, the major efforts are concentrated on the processing of data on nonmetallic solids and coatings. A new classification scheme for coatings has been developed after considerable study by the TPRC staff in consultation with several national experts. The coatings are now classified into conversion-diffusion coatings, contact coatings, pigmented coatings (vitreous enamels and paints), and uncharacterized coatings (commercial designations).

Although in the Retrieval Guide, second edition, there are only 2829 references on thermal radiative properties (8.4 percent of the 33 700 references), in recent years the number of new research documents on the thermal radiative properties has increased steadily and rapidly. Presently, 21 percent of the TPRC annual input are related to thermal radiative properties, and a half of these documents contains information on coatings.

d. Thermal Diffusivity

Thermal diffusivity will constitute Volume 10 of the TPRC DATA SERIES. The work on this property has been greatly accelerated since 1968. All the previous tables have been completely updated and revised and new research documents are processed to extend the scope of coverage. The recommended values for the thermal diffusivity of the elements are being generated also. Volume 10 of the TPRC DATA SERIES will be published in late 1970 and will contain the thermal diffusivity of elements, alloys, and many groups of nonmetallic solids.

e. Viscosity

Viscosity will constitute Volume 11 of the TPRC DATA SERIES. The work on this property had been suspended from 1964 to 1966. Starting early 1967 this work was reactivated in TPRC's European Branch at the Belgian Institute for High Pressure, Brussels, Belgium.

Data compilation for the same 56 fluids as covered by Volume 6 of the TPRC DATA SERIES and also for a number of refrigerants is well under way. Critical evaluation of the compiled data so as to generate the recommended reference values is also in progress. A computational procedure for generating the recommended values from experimental data has been fully established. This Volume 11 will be published in 1971.

f. Thermal Expansion (Linear and Volumetric)

Thermal expansion will constitute Volumes 12 and 13 of the TPRC DATA SERIES. This project was initiated in mid-1968 and has since been in full progress. The work includes both linear and volumetric expansion and covers elements, alloys, intermetallic compounds, and various groups of nonmetallic solids. The two volumes are planned to be published in 1972.

3. TPRC DATA SERIES

Synthesis of existing fragments of knowledge is as important as so-called original observation. The availability of adequate standard reference data tables is essential to national progress, economy, and defense. To this end TPRC has contributed greatly through the generation and dissemination of data tables on thermophysical properties.

The 13-volume TPRC Data Series brings together the most comprehensive and authoritative compilations of existing numerical data on thermophysical properties of materials. Recommended reference values of particular properties for particular materials are also often included. This new TPRC Data Series has evolved from the old three-volume loose-leaf 11" x 17" size TPRC Data Book, which was disseminated by TPRC from 1960 to 1967 and is well known nationally and, indeed, internationally. As of January 1967, the old TPRC Data Book contains 3322 data sheets, reporting 11 425 test specimens and citing 3424 references.

In view of the old TPRC Data Book's continuing rapid growth since 1960 and the extensive physical proportions it had assumed and in order to eliminate the cumbersome merging of supplements and the associated high cost of dissemination, it was decided in 1967 to discontinue the procedure of publication in loose-leaf format and its semi-annual dissemination by TPRC. Instead, the old Data Book has been restructured into volumes by properties and extensively updated, upgraded, and enlarged to become this new TPRC Data Series in 13 volumes.

One of the major improvements of the new TPRC Data Series over the old Data Book is that each volume of the Data Series includes also a comprehensive text on the theory, estimation, and measurement of the property and an overall material index, in addition to the most comprehensive compilation of numerical data. The text provides a general background and review of the theory and physics of the property considered in that volume, the methods for estimating the property values when experimental data are not available, and the experimental methods and apparatus for measuring the property. Such a background information enables the user to properly and fully utilize the compiled data and also enhance the usefulness of the data themselves. The material index lists alphabetically all the materials contained in that volume and in the companion volumes on the same property together with their respective volume numbers and page numbers. Many commercial designations of materials are cross-indexed with their previous designations and synonyms are cross-indexed with each other. Thus it enables the user to quickly locate the data for any material contained in the volume or in the companion volumes and to completely retrieve the desired data.

The numerical data for each material (except for the pure fluids) are presented in a full-page figure and also tabulated in a data table, accompanied by a specification table providing for every set of data a concise description of the sample characterization, as well as the method of measurement and test conditions. For the pure fluids of Volumes 3, 6 and 11, a critical discussion is given for each fluid in place of the specification table for the samples and data table for the raw data, which are presented through a departure plot, since all data have been critically reviewed and recommended values are presented.

Table V gives an indication of the structure, scope, and publication schedule of the TPRC Data Series. The first seven volumes of the Data Series have been completed and are in the publisher's hands for printing. They will soon be available through Plenum Press, New York, in the form of formal hard-bound volumes, 9-1/4" x 11-1/4" in size. It is contemplated that work on Volumes 8, 9 and 10 will be completed in late 1970. Table V also reflects the substantial increase in scope of Volumes 12 and 13, which are now anticipated to comprise 1000 pages each instead of 500 pages projected a year ago. The Table of Contents and Grouping of Materials and List of Figures and Tables of the completed first seven volumes are given in the Appendix.

TABLE V. PUBLICATION SCHEDULE FOR TPRC DATA SERIES*

	1970	1971	1972	1973	1974	1975	1976	1977	1978
Volume 1. Thermal Conductivity - Metallic Elements and Alloys	First Ed. 1600				Second Edition				
Volume 2. Thermal Conductivity - Nonmetallic Solids	First Ed. 1300				Second Edition				
Volume 3. Thermal Conductivity - Nonmetallic Liquids and Gases	First Ed. 700				Second Edition				
Volume 4. Specific Heat - Metallic Elements and Alloys	First Ed. 820					Second Edition			
Volume 5. Specific Heat - Nonmetallic Solids	First Ed. 1730					Second Edition			
Volume 6. Specific Heat - Nonmetallic Liquids and Gases	First Ed. 380					Second Edition			
Volume 7. Thermal Radiative Properties - Metallic Elements and Alloys	First Ed. 1650						Second Edition		
Volume 8. Thermal Radiative Properties - Nonmetallic Solids	First Ed. 880						Second Edition		
Volume 9. Thermal Radiative Properties - Coatings	First Ed. 1690						Second Edition		
Volume 10. Thermal Diffusivity	First Ed. 500							Second Edition	
Volume 11. Viscosity		First Ed. 600						Second Edition	
Volume 12. Thermal Expansion - Metallic Elements and Alloys			First Ed. 1000						Second Edition
Volume 13. Thermal Expansion - Nonmetallic Solids			First Ed. 1000						Second Edition

*Figures given under First Ed. represent estimated numbers of pages for the volumes. After the second edition, subsequent editions of each volume are to be released at intervals of five years.

As more volumes are readied for publication, an increasing number of the data tables and a number of the complete volumes will be in the form of critically evaluated and analyzed reference data. In fact, in the years ahead an increasingly larger portion of TPRC's total effort will be directed toward data analysis and synthesis along with data compilation. The former is a slow and painstaking task seldom fully appreciated by those who have not been involved with the generation or use of such information.

The continuing and systematic nature of this program makes the TPRC Data Series unique, quite distinctive from other data sources or handbooks, in that its coverage is constantly updated to maintain current and constantly upgraded to include more and more critically evaluated and analyzed standard reference data. Furthermore, for those users who have need for the most up-to-date information, TPRC will provide specific inquiry services or one may subscribe to the automatic data update plan tailored to meet a specific technical profile of an engineer, scientist, corporation, or laboratory. Thus, the user can always get the "last word" from the Data Series generator, TPRC.

The above-outlined procedure for data dissemination closely parallels the concept which TPRC has followed during the past twelve years for the dissemination of bibliographic information. In other words, TPRC publishes its major accomplishments in formal volumes through commercial channels while it directly disseminates up-to-date information to maintain its publications and audience on a current basis.

SECTION IV

TECHNICAL INQUIRY SERVICES

TPRC's contributions in information services continue to be primarily in the nature of technical advisory and consulting, data recommendations and predictions, and special bibliographic and data searches. During 1969, 436 inquiries (nearly nine per week) have been responded by TPRC covering various categories. Gratis responses to inquiries were given on an increasingly selective basis due to limited funds and time available for this purpose. Figure 1 gives an indication of the growth and distribution of these queries over the years. Figure 2 shows the detailed geographical distribution of the inquiries responded in 1969. As shown in Figure 2, these inquiries are from 36 states and District of Columbia and 21 foreign countries.

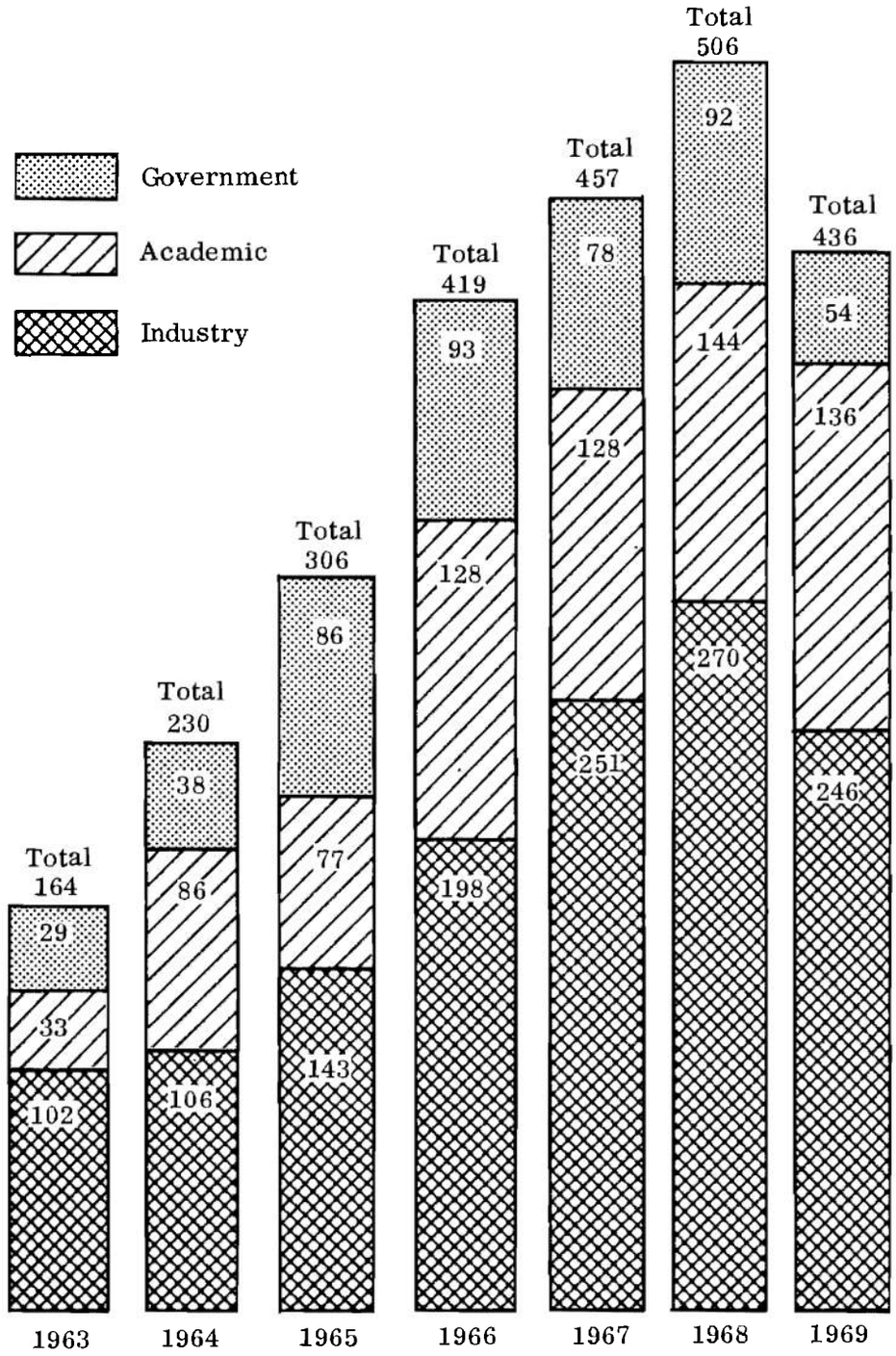

Figure 1. Growth and Distribution of TPRC's Inquiry Responses over the Years

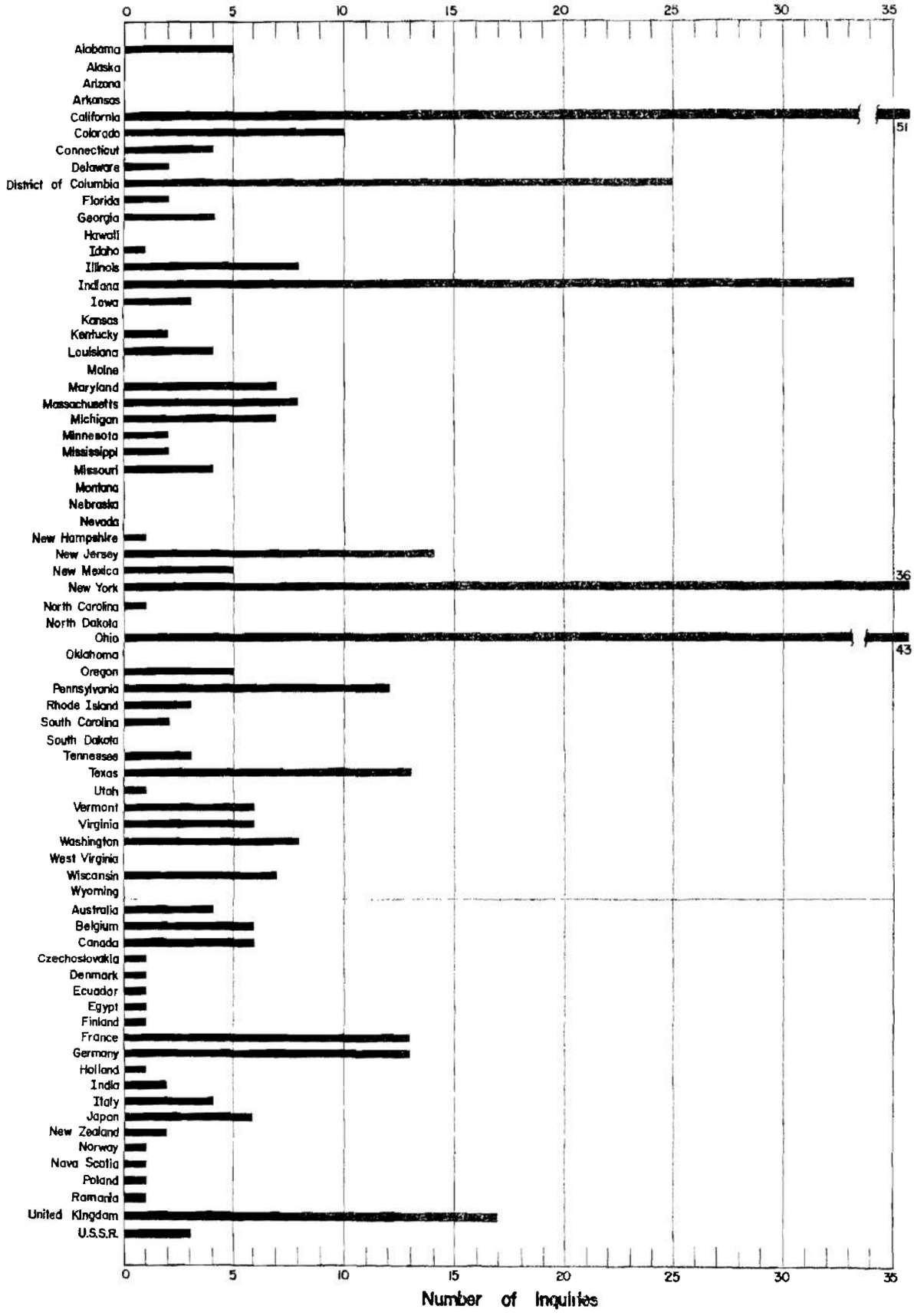

Figure 2. Geographical Distribution of Technical Inquiries for 1969

While Figure 1 indicates nearly a 14 percent decrease in the number of queries responded in 1969 over the preceding year, the time spent in answering these queries was 55 percent greater. It is of interest to note that, on the average, TPRC devoted approximately 72 hours to respond to a question requiring data analysis, 4.2 hours to answer a technical question, and 1.3 hours to respond to a query requesting literature. The average time spent per inquiry was 3.1 hours. These figures are substantially larger than the corresponding figures for 1968, primarily because TPRC devoted large block of time in 1969 to a few data analysis inquiries from the Air Force and NASA.

It is TPRC's aim and expectation that as our data books and other outputs are disseminated to the scientific and technical community on a worldwide basis through commercial publishers, the number of general technical inquiries will drop further. On the other hand, a larger number of engineers and scientists are becoming increasingly aware of TPRC's activities, thus reflecting a continuing incrase in inquiries concerning TPRC's services and capabilities.

SECTION V

OTHER PUBLICATIONS AND RELATED WORK NOT UNDER THIS CONTRACT

1. THERMOPHYSICAL PROPERTIES OF HIGH TEMPERATURE SOLID MATERIALS

"Thermophysical Properties of High Temperature Solid Materials," Y. S. Touloukian (Editor), Vol. 1 to 6, MacMillan Company, New York, 8479 pp., 1967.

This major encyclopedic reference work consists of 6 volumes comprising 9 books (since Volumes 2, 4 and 6 consist of 2 books each) with a total of 8479 pages reporting data from 2447 references for 14 381 specimens in 1375 material groups. This work is available from the MacMillan Company as individual volumes as well as a complete set. The general contents of the respective volumes are as follows:

Volume 1 - Elements

Volume 2 - Nonferrous Alloys
  Part I - Nonferrous Binary Alloys
  Part II - Nonferrous Multiple Alloys

Volume 3 - Ferrous Alloys

Volume 4 - Oxides and Their Solutions and Mixtures
Part I - Simple Oxygen Compounds and Their Mixtures
Part II - Solutions and Their Mixtures of Simple Oxygen Compounds, Including Glasses and Ceramic Materials

Volume 5 - Nonoxides and Their Solutions and Mixtures, Including Miscellaneous Ceramic Materials

Volume 6 - Intermetallics, Cermets, Polymers, and Composite Systems
Part I - Intermetallics
Part II - Cermets, Polymers, and Composite Systems

The twelve specific properties covered in each volume are: density, melting point, heat of fusion, heat of vaporization, heat of sublimations, electrical resistivity, specific heat at constant pressure, thermal conductivity, thermal diffusivity, thermal linear expansion, thermal radiative properties (absorptance, emittance, reflectance, and transmittance), and vapor pressure.

2. NATIONAL STANDARD REFERENCE DATA SERIES

As a component of the National Standard Reference Data System - National Bureau of Standards (NSRDS-NBS), TPRC has assumed its responsibility for the generation of Standard Reference Data on the thermophysical properties of substances and materials to meet the national needs. As a result, TPRC generates a series of reports giving recommended values of thermophysical properties of definable substances, materials, or systems. While all numerical data find their way in TPRC Data Series, these research reports discuss in detail the considerations involved in arriving at the recommended reference values with a full assessment of the experimental data and theoretical guidelines on which the critical evaluation is based. The reports are normally released by TPRC first in the form of a "preliminary report" and distributed internationally to a number of experts for review and criticism. The formal reports are then published under NSRDS auspices and released in the National Standard Reference Data Series.

TPRC's activity in this area during the first two years (1 June 1964 to 30 June 1966) was concentrated on the generation of critical tables of the thermal conductivity of specifically selected materials. This results in the following two reports:

(1) "Thermal Conductivity of Selected Materials," R. W. Powell, C. Y. Ho, and P. E. Liley, National Standard Reference Data Series - National Bureau of Standards NSRDS-NBS 8, 1-168, 1966.

A total of 29 substances and materials are studied. These are the metals aluminum, copper, gold, Armco iron, iron, manganin, mercury, platinum, platinum-rhodium (40%) alloy, silver, tungsten; the nonmetallic solids aluminum oxide, beryllium oxide, Corning code 7740 glass, diamond, magnesium oxide, Pyroceram brand glass-ceramic code 9606, quartz, thorium dioxide, titanium dioxide; and the fluids argon, carbon tetrachloride, diphenyl, helium, nitrogen, m-terphenyl, p-terphenyl, toluene, and water.

(2) "Thermal Conductivity of Selected Materials, Part 2," C. Y. Ho, R. W. Powell, and P. E. Liley, National Standard Reference Data Series - National Bureau of Standards NSRDS-NBS 16, 1-146, 1968.

A total of 16 substances and materials are studied. These are the metals cadmium, chromium, lead, magnesium, molybdenum, nickel, niobium, tantalum, tin, titanium, zinc, zirconium; the nonmetal graphite (5 species); and the fluids acetone, ammonia, and methane.

In 1967 and 1968 efforts were concentrated on the generation of critical tables of the thermal conductivity of the elements which are not covered in the above two reports. Efforts were also made to expand the tables for the elements which are in liquid or gaseous state at normal temperature and pressure to include recommended values for the solid and saturated vapor states also. This results in the following "preliminary report":

(3) "Standard Reference Data on the Thermal Conductivity of Selected Materials, Part 3," C. Y. Ho, R. W. Powell, and P. E. Liley, Thermophysical Properties Research Center Final Report on NSRDS-NBS Contract CST-1346, 1-435, 1968.

A total of 68 elements are studied. These are antimony, argon, arsenic, barium, beryllium, bismuth, boron, bromine, calcium, cerium, cesium, chlorine, cobalt, dysprosium, erbium, europium, fluorine, gadolinium, gallium, germanium, hafnium, helium, holmium, hydrogen (including deuterium and tritium), indium, iodine, iridium, krypton, lanthanum, lithium, lutetium, manganese, neodymium, neon, neptunium, nitrogen, osmium, oxygen, palladium, phosphorus, rhodium, rubidium, ruthenium, samarium, scandium, selenium, silicon, sodium, strontium, sulfur, technetium, tellurium, terbium, thallium, thorium, thulium, uranium, vanadium, xenon, ytterbium, and yttrium. For most of the nonmetallic elements which

are liquid or gaseous at normal temperature and pressure, recommended values are given for solid, saturated liquid, saturated vapor, and atmospheric-pressure gaseous states. For the other elements, recommended values are provided mainly for the solid state, though values for both solid and liquid states are given for 13 elements.

After five years of diligent effort, we have completed the critical evaluation, analysis and synthesis of the available data for the thermal conductivity of the elements across the periodic table. This five-year effort is now in the process of final review and updating, and it is anticipated that a definitive work on the program entitled "Thermal Conductivity of the Elements" will become available in 1970 under the auspices of the National Bureau of Standards, Office of Standard Reference Data.

3. MASTERS THESES IN THE PURE AND APPLIED SCIENCES

"Masters Theses in the Pure and Applied Sciences Accepted by Colleges and Universities of the United States," Beth M. Schick (Editor), Volumes I to XIII.

This work provides a unique source of information on current academic research and serves as a barometer on research trends.

This annual publication has evolved from a rather limited attempt to report masters thesis titles in five disciplines to include all the pure and applied sciences (except mathematics and the life sciences). In Volume III, an experiment was made to report doctoral dissertations as well, but this was discontinued in subsequent volumes. Because of the gradual development of this publication it has undergone some modifications of its title in the first three volumes; however, the work is now recognized as listed above. The volumes contain a table of contents and an index to the universities and colleges. A brief statistical summary of coverage is given below.

Masters Theses in the Pure and Applied Sciences

	Thesis Year	Contributing Institutions	Titles Reported
Volume I			
Part I	1955	93	1002
Part II	1956	93	1027
Volume II	1957	154	1727
Volume III*			
Part I	1958	139	3736
Volume IV	1959	162	4984
Volume V	1960	183	5708
Volume VI	1961	186	5911
Volume VII	1962	186	6321
Volume VIII	1963	175	6505
Volume IX	1964	174	6940
Volume X	1965	170	7310
Volume XI	1966	173	7099
Volume XII	1967	167	6909
Volume XIII**	1968	174	7802

*Part II of Volume III includes doctoral dissertations for 1956-57 academic year, citing 2846 titles from 103 universities.

**Effective with Volume XIII, "Masters Theses in the Pure and Applied Sciences" appears under a new cover design and represents a turning point in the twelve-year publication of this unique reference work as the Thermophysical Properties Research Center (TPRC) and University Microfilms Library Services, Ann Arbor, Michigan, join forces in its publication. As in the past, TPRC will gather the thesis titles and will prepare the manuscript for the volume while the University Microfilms will print and disseminate this work on a worldwide basis. Back volumes of the "Masters Theses in the Pure and Applied Sciences" may also be purchased from University Microfilms.

SECTION VI

CONCLUSIONS

This technical report has covered those phases of TPRC's activities which are either fully or partly funded under this contract for the period 1 January to 31 December 1969, and has also described briefly a number of related activities not under this contract. The results of this program are disseminated at large through two major publications: the Thermophysical Properties Research Literature Retrieval Guide and the TPRC Data Series.

The total efforts at TPRC are centered on the single goal of the advancement of knowledge concerning all aspects of thermophysics and thermophysical properties of materials. Comprehensiveness of treatment, compatible with the highest scientific and engineering standards, forms the basic guiding philosophy of performance. To the extent that TPRC's activities constitute a continuing systematic program, the planning of its activities is geared to both short range as well as long range goals, thus leading to effective utilization of both intellectual and fiscal resources.

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- Grouping of Materials and List of Figures and Tables

Volume 2. Thermal Conductivity - Nonmetallic Solids
- Contents
- Grouping of Materials and List of Figures and Tables

Volume 3. Thermal Conductivity - Nonmetallic Liquids and Gases
- Contents
- Grouping of Materials and List of Figures and Tables

Volume 4. Specific Heat - Metallic Elements and Alloys
- Contents
- Grouping of Materials and List of Figures and Tables

Volume 5. Specific Heat - Nonmetallic Solids
- Contents
- Grouping of Materials and List of Figures and Tables

Volume 6. Specific Heat - Nonmetallic Liquids and Gases
- Contents
- Grouping of Materials and List of Figures and Tables

Volume 7. Thermal Radiative Properties - Metallic Elements and Alloys
- Contents
- Grouping of Materials and List of Figures and Tables

VOLUME 1. THERMAL CONDUCTIVITY - METALLIC ELEMENTS AND ALLOYS

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GROUPING OF MATERIALS AND LIST OF FIGURES AND TABLES

1. ELEMENTS

Figure and/or Table No.	Name	Symbol	Page No.
1*	Aluminum	Al	1
2*	Antimony	Sb	10
3	Arsenic	As	15
4*	Beryllium	Be	18
5*	Bismuth	Bi	25
6*	Boron	B	41
7*	Cadmium	Cd	45
8*	Cerium	Ce	50
9*	Cesium	Cs	54
10*	Chromium	Cr	60
11*	Cobalt	Co	64
12*	Copper	Cu	68
13*	Dysprosium	Dy	82
14*	Erbium	Er	86
15	Europium	Eu	90
16*	Gadolinium	Gd	93
17*	Gallium	Ga	97
18*	Germanium	Ge	108
19*	Gold	Au	132
20*	Hafnium	Hf	138
21*	Holmium	Ho	142
22*	Indium	In	146
23*	Iridium	Ir	152
24*	Iron	Fe	156
25*	Lanthanum	La	171
26*	Lead	Pb	175
27*	Lithium	Li	192
28*	Lutetium	Lu	198
29*	Magnesium	Mg	202
30*	Manganese	Mn	208
31*	Mercury	Hg	212
32*	Molybdenum	Mo	222
33*	Neodymium	Nd	230
34	Neptunium	Np	234
35*	Nickel	Ni	237
36*	Niobium	Nb	245
37*	Osmium	Os	254
38*	Palladium	Pd	258
39*	Platinum	Pt	262

* Number marked with an asterisk indicates that recommended values are also reported for this material on separate figure and table of the same number followed by the letter R.

1. ELEMENTS (continued)

Figure and/or Table No.	Name	Symbol	Page No.
40*	Plutonium	Pu	270
41*	Potassium	K	274
42*	Praseodymium	Pr	281
43	Promethium	Pm	285
44*	Rhenium	Re	288
45*	Rhodium	Rh	292
46*	Rubidium	Rb	296
47*	Ruthenium	Ru	300
48*	Samarium	Sm	305
49*	Scandium	Sc	309
50*	Selenium	Se	313
51*	Silicon	Si	326
52*	Silver	Ag	340
53*	Sodium	Na	349
54*	Tantalum	Ta	355
55	Technetium	Tc	363
56*	Tellurium	Te	366
57*	Terbium	Tb	372
58*	Thallium	Tl	376
59*	Thorium	Th	381
60*	Thulium	Tm	385
61*	Tin	Sn	389
62*	Titanium	Ti	410
63*	Tungsten	W	415
64*	Uranium	U	429
65*	Vanadium	V	441
66*	Ytterbium	Yb	446
67*	Yttrium	Y	449
68*	Zinc	Zn	453
69*	Zirconium	Zr	461

2. NONFERROUS BINARY ALLOYS

Figure and/or Table No.	Name	Formula	Page No.
70	Aluminum + Antimony	Al + Sb	469
71	Aluminum + Copper	Al + Cu	470
72	Aluminum + Iron	Al + Fe	474
73	Aluminum + Magnesium	Al + Mg	477
74	Aluminum + Silicon	Al + Si	480
75	Aluminum + Tin	Al + Sn	483
76	Aluminum + Uranium	Al + U	484
77	Aluminum + Zinc	Al + Zn	487
78	Antimony + Aluminum	Sb + Al	488
79	Antimony + Bismuth	Sb + Bi	489

* Number marked with an asterisk indicates that recommended values are also reported for this material on separate figure and table of the same number followed by the letter R.

2. NONFERROUS BINARY ALLOYS (continued)

Figure and/or Table No.	Name	Formula	Page No.
80	Antimony + Cadmium	Sb + Cd	492
81	Antimony + Copper	Sb + Cu	495
82	Antimony + Lead	Sb + Pb	496
83	Antimony + Tin	Sb + Sn	497
84	Beryllium + Aluminum	Be + Al	498
85	Beryllium + Magnesium	Be + Mg	499
86	Bismuth + Antimony	Bi + Sb	502
87	Bismuth + Cadmium	Bi + Cd	505
88	Bismuth + Lead	Bi + Pb	508
89	Bismuth + Tin	Bi + Sn	511
90	Cadmium + Antimony	Cd + Sb	514
91	Cadmium + Bismuth	Cd + Bi	517
92	Cadmium + Thallium	Cd + Tl	520
93	Cadmium + Tin	Cd + Sn	521
94	Cadmium + Zinc	Cd + Zn	524
95	Chromium + Nickel	Cr + Ni	525
96	Cobalt + Carbon	Co + C	526
97	Cobalt + Chromium	Co + Cr	527
98	Cobalt + Nickel	Co + Ni	528
99	Copper + Aluminum	Cu + Al	530
100	Copper + Antimony	Cu + Sb	534
101	Copper + Arsenic	Cu + As	535
102	Copper + Beryllium	Cu + Be	538
103	Copper + Cadmium	Cu + Cd	541
104	Copper + Chromium	Cu + Cr	542
105	Copper + Cobalt	Cu + Co	545
106	Copper + Gold	Cu + Au	548
107	Copper + Iron	Cu + Fe	551
108	Copper + Lead	Cu + Pb	554
109	Copper + Manganese	Cu + Mn	557
110	Copper + Nickel	Cu + Ni	561
111	Copper + Palladium	Cu + Pd	568
112	Copper + Phosphorus	Cu + P	571
113	Copper + Platinum	Cu + Pt	574
114	Copper + Silicon	Cu + Si	575
115	Copper + Silver	Cu + Ag	578
116	Copper + Tellurium	Cu + Te	581
117	Copper + Tin	Cu + Sn	584
118	Copper + Zinc	Cu + Zn	588
119	Germanium + Silicon	Ge + Si	597
120	Gold + Cadmium	Au + Cd	600
121	Gold + Chromium	Au + Cr	603
122	Gold + Cobalt	Au + Co	606
123	Gold + Copper	Au + Cu	609
124	Gold + Palladium	Au + Pd	614
125	Gold + Platinum	Au + Pt	617
126	Gold + Silver	Au + Ag	620

2. NONFERROUS BINARY ALLOYS (continued)

Figure and/or Table No.	Name	Formula	Page No.
127	Gold + Zinc	Au + Zn	623
128	Hafnium + Zirconium	Hf + Zr	624
129	Indium + Lead	In + Pb	627
130	Indium + Thallium	In + Tl	630
131	Indium + Tin	In + Sn	634
132	Lead + Antimony	Pb + Sb	637
133	Lead + Bismuth	Pb + Bi	640
134	Lead + Indium	Pb + In	643
135	Lead + Silver	Pb + Ag	646
136	Lead + Thallium	Pb + Tl	649
137	Lead + Tin	Pb + Sn	652
138	Lithium + Sodium	Li + Na	655
139	Magnesium + Aluminum	Mg + Al	658
140	Magnesium + Cadmium	Mg + Cd	661
141	Magnesium + Calcium	Mg + Ca	662
142	Magnesium + Cerium	Mg + Ce	663
143	Magnesium + Copper	Mg + Cu	666
144	Magnesium + Manganese	Mg + Mn	669
145	Magnesium + Nickel	Mg + Ni	672
146	Magnesium + Silicon	Mg + Si	675
147	Magnesium + Silver	Mg + Ag	678
148	Magnesium + Tin	Mg + Sn	679
149	Magnesium + Zinc	Mg + Zn	680
150	Manganese + Copper	Mn + Cu	683
151	Manganese + Iron	Mn + Fe	684
152	Manganese + Nickel	Mn + Ni	685
153	Mercury + Sodium	Hg + Na	686
154	Molybdenum + Iron	Mo + Fe	690
155	Molybdenum + Titanium	Mo + Ti	691
156	Molybdenum + Tungsten	Mo + W	694
157	Nickel + Chromium	Ni + Cr	697
158	Nickel + Cobalt	Ni + Co	700
159	Nickel + Copper	Ni + Cu	703
160	Nickel + Iron	Ni + Fe	707
161	Nickel + Manganese	Ni + Mn	710
162	Niobium + Uranium	Nb + U	713
163	Niobium + Zirconium	Nb + Zr	716
164	Palladium + Copper	Pd + Cu	720
165	Palladium + Gold	Pd + Au	723
166	Palladium + Platinum	Pd + Pt	726
167	Palladium + Silver	Pd + Ag	727
168	Platinum + Copper	Pt + Cu	730
169	Platinum + Gold	Pt + Au	733
170	Platinum + Iridium	Pt + Ir	734
171	Platinum + Palladium	Pt + Pd	737
172*	Platinum + Rhodium	Pt + Rh	738

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2. NONFERROUS BINARY ALLOYS (continued)

Figure and/or Table No.	Name	Formula	Page No.
173	Platinum + Ruthenium	Pt + Ru	743
174	Platinum + Silver	Pt + Ag	745
175	Plutonium + Aluminum	Pu + Al	746
176	Plutonium + Iron	Pu + Fe	747
177	Potassium + Sodium	K + Na	748
178	Rubidium + Cesium	Rb + Cs	751
179	Selenium + Bromine	Se + Br	754
180	Selenium + Cadmium	Se + Cd	755
181	Selenium + Chlorine	Se + Cl	756
182	Selenium + Iodine	Se + I	757
183	Selenium + Thallium	Se + Tl	758
184	Silicon + Germanium	Se + Ge	761
185	Silicon + Iron	Si + Fe	764
186	Silver + Antimony	Ag + Sb	767
187	Silver + Cadmium	Ag + Cd	770
188	Silver + Copper	Ag + Cu	773
189	Silver + Gold	Ag + Au	774
190	Silver + Indium	Ag + In	777
191	Silver + Lead	Ag + Pb	780
192	Silver + Manganese	Ag + Mn	783
193	Silver + Palladium	Ag + Pd	786
194	Silver + Platinum	Ag + Pt	790
195	Silver + Tin	Ag + Sn	791
196	Silver + Zinc	Ag + Zn	792
197	Sodium + Mercury	Na + Hg	795
198	Sodium + Potassium	Na + K	798
199	Tantalum + Niobium	Ta + Nb	801
200	Tantalum + Tungsten	Ta + W	802
201	Tellurium + Selenium	Te + Se	805
202	Tellurium + Thallium	Te + Tl	808
203	Thallium + Cadmium	Tl + Cd	811
204	Thallium + Indium	Tl + In	812
205	Thallium + Lead	Tl + Pb	815
206	Thallium + Tellurium	Tl + Te	818
207	Thallium + Tin	Tl + Sn	821
208	Thorium + Uranium	Th + U	822
209	Tin + Aluminum	Sn + Al	823
210	Tin + Antimony	Sn + Sb	824
211	Tin + Bismuth	Sn + Bi	827
212	Tin + Cadmium	Sn + Cd	830
213	Tin + Copper	Sn + Cu	833
214	Tin + Indium	Sn + In	834
215	Tin + Lead	Sn + Pb	839
216	Tin + Mercury	Sn + Hg	842
217	Tin + Silver	Sn + Ag	845
218	Tin + Thallium	Sn + Tl	846

2. NONFERROUS BINARY ALLOYS (continued)

Figure and/or Table No.	Name	Formula	Page No.
219	Tin + Zinc	Sn + Zn	847
220	Titanium + Aluminum	Ti + Al	848
221	Titanium + Manganese	Ti + Mn	849
222	Titanium + Oxygen	Ti + O	852
223	Tungsten + Rhenium	W + Re	855
224	Uranium + Aluminum	U + Al	858
225	Uranium + Chromium	U + Cr	859
226	Uranium + Iron	U + Fe	862
227	Uranium + Magnesium	U + Mg	863
228	Uranium + Molybdenum	U + Mo	864
229	Uranium + Niobium	U + Nb	867
230	Uranium + Silicon	U + Si	868
231	Uranium + Zirconium	U + Zr	871
232	Vanadium + Iron	V + Fe	874
233	Vanadium + Yttrium	V + Y	877
234	Zinc + Aluminum	Zn + Al	880
235	Zinc + Cadmium	Zn + Cd	881
236	Zirconium + Aluminum	Zr + Al	882
237	Zirconium + Hafnium	Zr + Hf	883
238	Zirconium + Niobium	Zr + Nb	886
239	Zirconium + Tin	Zr + Sn	887
240	Zirconium + Titanium	Zr + Ti	890
241	Zirconium + Uranium	Zr + U	891

3. NONFERROUS MULTIPLE ALLOYS

242	Aluminum + Copper + ΣX_i	Al + Cu + ΣX_i	895
243	Aluminum + Iron + ΣX_i	Al + Fe + ΣX_i	905
244	Aluminum + Magnesium + ΣX_i	Al + Mg + ΣX_i	908
245	Aluminum + Manganese + ΣX_i	Al + Mn + ΣX_i	911
246	Aluminum + Nickel + ΣX_i	Al + Ni + ΣX_i	914
247	Aluminum + Silicon + ΣX_i	Al + Si + ΣX_i	917
248	Aluminum + Zinc + ΣX_i	Al + Zn + ΣX_i	922
249	Aluminum + ΣX_i	Al + ΣX_i	925
250	Antimony + Beryllium + ΣX_i	Sb + Be + ΣX_i	926
251	Beryllium + Fluorine + ΣX_i	Be + F + ΣX_i	929
252	Beryllium + Magnesium + ΣX_i	Be + Mg + ΣX_i	932
253	Bismuth + Cadmium + ΣX_i	Bi + Cd + ΣX_i	935
254	Bismuth + Lead + ΣX_i	Bi + Pb + ΣX_i	938
255	Cadmium + Bismuth + ΣX_i	Cd + Bi + ΣX_i	941
256	Chromium + Iron + ΣX_i	Cr + Fe + ΣX_i	944
257	Cobalt + Chromium + ΣX_i	Co + Cr + ΣX_i	947
258	Cobalt + Iron + ΣX_i	Co + Fe + ΣX_i	950
259	Cobalt + Nickel + ΣX_i	Co + Ni + ΣX_i	951
260	Copper + Aluminum + ΣX_i	Cu + Al + ΣX_i	952

3. NONFERROUS MULTIPLE ALLOYS (continued)

Figure and/or Table No.	Name	Formula	Page No.
261	Copper + Beryllium + ΣX_i	Cu + Be + ΣX_i	955
262	Copper + Cadmium + ΣX_i	Cu + Cd + ΣX_i	956
263	Copper + Cobalt + ΣX_i	Cu + Co + ΣX_i	957
264	Copper + Iron + ΣX_i	Cu + Fe + ΣX_i	960
265	Copper + Lead + ΣX_i	Cu + Pb + ΣX_i	961
266*	Copper + Manganese + ΣX_i	Cu + Mn + ΣX_i	964
267	Copper + Nickel + ΣX_i	Cu + Ni + ΣX_i	969
268	Copper + Silicon + ΣX_i	Cu + Si + ΣX_i	972
269	Copper + Tin + ΣX_i	Cu + Sn + ΣX_i	975
270	Copper + Zinc + ΣX_i	Cu + Zn + ΣX_i	979
271	Copper + Zirconium + ΣX_i	Cu + Zr + ΣX_i	985
272	Lanthanum + Neodymium + ΣX_i	La + Nd + ΣX_i	988
273	Lead + Antimony + ΣX_i	Pb + Sb + ΣX_i	991
274	Lithium + Boron + ΣX_i	Li + B + ΣX_i	992
275	Lithium + Sodium + ΣX_i	Li + Na + ΣX_i	995
276	Magnesium + Aluminum + ΣX_i	Mg + Al + ΣX_i	998
277	Magnesium + Cerium + ΣX_i	Mg + Ce + ΣX_i	1001
278	Magnesium + Cobalt + ΣX_i	Mg + Co + ΣX_i	1004
279	Magnesium + Copper + ΣX_i	Mg + Cu + ΣX_i	1005
280	Magnesium + Nickel + ΣX_i	Mg + Ni + ΣX_i	1008
281	Manganese + Iron + ΣX_i	Mn + Fe + ΣX_i	1009
282	Manganese + Silicon + ΣX_i	Mn + Si + ΣX_i	1012
283	Molybdenum + Iron + ΣX_i	Mo + Fe + ΣX_i	1013
284	Nickel + Aluminum + ΣX_i	Ni + Al + ΣX_i	1014
285*	Nickel + Chromium + ΣX_i	Ni + Cr + ΣX_i	1017
286	Nickel + Cobalt + ΣX_i	Ni + Co + ΣX_i	1028
287	Nickel + Copper + ΣX_i	Ni + Cu + ΣX_i	1031
288	Nickel + Iron + ΣX_i	Ni + Fe + ΣX_i	1035
289	Nickel + Manganese + ΣX_i	Ni + Mn + ΣX_i	1038
290	Nickel + Molybdenum + ΣX_i	Ni + Mo + ΣX_i	1041
291	Nickel + ΣX_i	Ni + ΣX_i	1044
292	Niobium + Molybdenum + ΣX_i	Nb + Mo + ΣX_i	1046
293	Niobium + Tantalum + ΣX_i	Nb + Ta + ΣX_i	1049
294	Niobium + Titanium + ΣX_i	Nb + Ti + ΣX_i	1052
295	Niobium + Tungsten + ΣX_i	Nb + W + ΣX_i	1055
296	Silver + Cadmium + ΣX_i	Ag + Cd + ΣX_i	1058
297	Silver + ΣX_i	Ag + ΣX_i	1061
298	Tantalum + Niobium + ΣX_i	Ta + Nb + ΣX_i	1062
299	Tantalum + Tungsten + ΣX_i	Ta + W + ΣX_i	1065
300	Tellurium + Arsenic + ΣX_i	Te + As + ΣX_i	1068
301	Tin + Antimony + ΣX_i	Sn + Sb + ΣX_i	1069
302	Tin + Copper + ΣX_i	Sn + Cu + ΣX_i	1072
303	Titanium + Aluminum + ΣX_i	Ti + Al + ΣX_i	1073
304	Titanium + Chromium + ΣX_i	Ti + Cr + ΣX_i	1077
305	Titanium + Iron + ΣX_i	Ti + Fe + ΣX_i	1080
306	Titanium + Manganese + ΣX_i	Ti + Mn + ΣX_i	1083

* Number marked with an asterisk indicates that recommended values are also reported for this material on separate figure and table of the same number followed by the letter R.

3. NONFERROUS MULTIPLE ALLOYS (continued)

Figure and/or Table No.	Name	Formula		Page No.
307	Titanium + Vanadium + ΣX_i	Ti + V + ΣX_i		1086
308	Titanium + ΣX_i	Ti + ΣX_i		1089
309	Tungsten + Iron + ΣX_i	W + Fe + ΣX_i		1090
310	Tungsten + Nickel + ΣX_i	W + Ni + ΣX_i		1091
311	Uranium + Molybdenum + ΣX_i	U + Mo + ΣX_i		1094
312	Uranium + Zirconium + ΣX_i	U + Zr + ΣX_i		1097
313	Zinc + Aluminum + ΣX_i	Zn + Al + ΣX_i		1098
314	Zinc + Lead + ΣX_i	Zn + Pb + ΣX_i		1099
315	Zirconium + Aluminum + ΣX_i	Zr + Al + ΣX_i		1100
316	Zirconium + Hafnium + ΣX_i	Zr + Hf + ΣX_i		1101
317	Zirconium + Molybdenum + ΣX_i	Zr + Mo + ΣX_i		1104
318	Zirconium + Tantalum + ΣX_i	Zr + Ta + ΣX_i		1105
319	Zirconium + Tin + ΣX_i	Zr + Sn + ΣX_i		1108
320	Zirconium + Uranium + ΣX_i	Zr + U + ΣX_i		1111
321	Zirconium + ΣX_i	Zr + ΣX_i		1112

4. FERROUS ALLOYS

A. CARBON STEELS

322	Iron + Carbon + ΣX_i	Fe + C + ΣX_i	Group I	1113
323	Iron + Carbon + ΣX_i	Fe + C + ΣX_i	Group II	1124

B. CAST IRONS

324	Iron + Carbon + ΣX_i	Fe + C + ΣX_i	Group I	1128
325	Iron + Carbon + ΣX_i	Fe + C + ΣX_i	Group II	1132

C. ALLOY STEELS

326	Iron + Aluminum + ΣX_i	Fe + Al + ΣX_i	Group I	1142
327	Iron + Aluminum + ΣX_i	Fe + Al + ΣX_i	Group II	1145
328	Iron + Chromium + ΣX_i	Fe + Cr + ΣX_i	Group I	1148
329	Iron + Chromium + ΣX_i	Fe + Cr + ΣX_i	Group II	1152
330	Iron + Chromium + Nickel + ΣX_i	Fe + Cr + Ni + ΣX_i	Group I	1160
331*	Iron + Chromium + Nickel + ΣX_i	Fe + Cr + Ni + ΣX_i	Group II	1164
332	Iron + Cobalt + ΣX_i	Fe + Co + ΣX_i	Group II	1176
333	Iron + Copper + ΣX_i	Fe + Cu + ΣX_i	Group I	1179
334	Iron + Manganese + ΣX_i	Fe + Mn + ΣX_i	Group I	1182
335	Iron + Manganese + ΣX_i	Fe + Mn + ΣX_i	Group II	1191
336	Iron + Molybdenum + ΣX_i	Fe + Mo + ΣX_i	Group II	1194
337	Iron + Nickel + ΣX_i	Fe + Ni + ΣX_i	Group I	1197
338	Iron + Nickel + ΣX_i	Fe + Ni + ΣX_i	Group II	1202
339	Iron + Nickel + Chromium + ΣX_i	Fe + Ni + Cr + ΣX_i	Group I	1209
340	Iron + Nickel + Chromium + ΣX_i	Fe + Ni + Cr + ΣX_i	Group II	1212

* Number marked with an asterisk indicates that recommended values are also reported for this material on separate figure and table of the same number followed by the letter R.

4. FERROUS ALLOYS (continued)

Figure and/or Table No.	Name	Formula		Page No.
C. ALLOY STEELS (continued)				
341	Iron + Phosphorus + ΣX_i	$Fe + P + \Sigma X_i$	Group I	1216
342	Iron + Silicon + ΣX_i	$Fe + Si + \Sigma X_i$	Group I	1217
343	Iron + Silicon + ΣX_i	$Fe + Si + \Sigma X_i$	Group II	1221
344	Iron + Titanium + ΣX_i	$Fe + Ti + \Sigma X_i$	Group I	1225
345	Iron + Tungsten + ΣX_i	$Fe + W + \Sigma X_i$	Group I	1226
346	Iron + Tungsten + ΣX_i	$Fe + W + \Sigma X_i$	Group II	1229

5. INTERMETALLIC COMPOUNDS

Figure and/or Table No.	Formula	Page No.
347	Sb_2Te_3	1241
348	As_2Te_3	1244
349	Ba_2Pb	1245
350	Ba_2Sn	1246
351	Be_xNb_y	1247
352	Be_xTa_y	1250
353	Be_xU_y	1253
354	$Be_{13}Zr$	1256
355	Bi_2Te_3	1257
356	B_xSi_y	1262
357	CdSb	1264
358	CdTe	1267
359	Ca_xPb_y	1270
360	Ca_2Sn	1273
361	CoSi	1274
362	$CuSbSe_2$	1275
363	Cu_2Se_2	1276
364	GaAs	1277
365	GeTe	1280
366	Au_xCu_y	1281
367	HfB_2	1284
368	InSb	1287
369	InAs	1292
370	In_2Se_3	1295
371	In_2Te_3	1298
372	LaSe	1301
373	LaTe	1304
374	PbTe	1307
375	Mg_3Sb_2	1310
376	Mg_2Ge	1311
377	Mg_2Si	1314
378	Mg_2Sn	1317

5. INTERMETALLIC COMPOUNDS (continued)

Figure and/or Table No.	Formula	Page No.
379	HgSe	1320
380	HgTe	1321
381	$MoSi_2$	1324
382	NiSb	1327
383	Re_3As_7	1330
384	Re_xGe_y	1331
385	$ReSe_2$	1332
386	$AgSbTe_2$	1335
387	AgCu	1338
388	Ag_2Se	1339
389	Ag_xTe_y	1342
390	Sr_2Si	1343
391	Sr_2Sn	1344
392	TaB_2	1345
393	$TaGe_2$	1348
394	Tl_2Pb	1349
395	$SnSe_2$	1352
396	SnTe	1355
397	TiB_2	1358
398	TiNi	1361
399	W_3As_7	1364
400	WB	1365
401	WSe_2	1368
402	WSi_2	1369
403	WTe_2	1370
404	ZnSe	1371
405	$ZnSiAs_2$	1374
406	ZrB	1375

6. MIXTURES OF INTERMETALLIC COMPOUNDS

407	$Sb_2Se_3 + Ag_2Se + PbSe$	1379
408	$Sb_2Te_3 + Bi_2Te_3$	1380
409	$Sb_2Te_3 + In_2Te_3$	1386
410	$Bi_2Te_3 + Sb_2Te_3$	1388
411	$Bi_2Te_3 + Sb_2Te_3 + Sb_2Se_3$	1392
412	$Bi_2Te_3 + Bi_2Se_3$	1393
413	$Cd_3As_2 + Zn_3As_2$	1396
414	CdSb + ZnSb	1397
415	$CuSbSe_2 + Cu_3Se_2$	1400
416	$Cu_3Se_2 + CuSbSe_2$	1401
417	InSb + In_2Te_3	1403
418	$In_2Te_3 + Cu_2Te + Ag_2Te$	1406
419	HgTe + CdTe	1407
420	$AgSbTe_2$ + SnTe	1410

6. MIXTURES OF INTERMETALLIC COMPOUNDS (continued)

Figure and/or Table No.	Formula	Page No.
421	$SnTe + AgSbTe_2$	1411
422	$ZnSb + CdSb$	1412

7. MISCELLANEOUS ALLOYS AND MIXTURES

423	$Bi_2Te_3 + Te$	1415
424	$Be + BeO$	1416
425	$Cr + Al_2O_3$	1419
426	$Cu + BeCo$	1420
427	$GaAs + GaP$	1423
428	$InAs + InP$	1426
429	$Mo + ThO_2$	1429
430	$Na + Na_2O$	1432
431	$TiNi + Cu$	1433
432	$TiNi + Ni$	1436
433	$W + ThO_2$	1439
434	$U + UO_2$	1442
435	$Zr + ZrO_2$	1444

VOLUME 2. THERMAL CONDUCTIVITY - NONMETALLIC SOLIDS

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MATERIAL INDEX

Page

MATERIAL INDEX TO THERMAL CONDUCTIVITY COMPANION VOLUMES 1, 2, and 3 A1

GROUPING OF MATERIALS AND LIST OF FIGURES AND TABLES

1. ELEMENTS

Figure and/or Table No.	Name	Symbol	Page No.
1*	Boron	B	1
2	Carbon	C	5
3*	Carbon (Diamond)	C	9
	Carbon (Graphite)	C	
4	AGOT Graphite		13
5*	ATJ Graphite		20
6	AWG Graphite		24
7*	Pyrolytic Graphite		30
8	SA-25 Graphite		42
9*	875S Graphite		45
10*	890S Graphite		49
11	Miscellaneous Graphite		53
12*	Iodine	I	83
13*	Phosphorus	P	86
14*	Sulfur	S	89

2. SINGLE OXIDES

Figure and/or Table No.	Name	Formula	Page No.
15*	Aluminum Oxide (Sapphire)	Al_2O_3	93
16*	Aluminum Oxide	Al_2O_3	98
17	Barium Oxide	BaO	120
18*	Beryllium Oxide	BeO	123
19	Boron Oxide	B_2O_3	138
20	Calcium Oxide	CaO	141
21	Cerium Dioxide	CeO_2	144
22	(di)Copper Oxide	Cu_2O	147
23	Hafnium Dioxide	HfO_2	150
24	Indium Oxide	InO	153
25	(tri)Iron Tetraoxide	Fe_3O_4	154
26	Lithium Oxide	Li_2O	157
27*	Magnesium Oxide	MgO	158
28	Manganese Oxide	MnO	168
29	(tri)Manganese Tetraoxide	Mn_3O_4	170
30	Nickel Oxide	NiO	171
31*	Silicon Dioxide (Crystalline)	SiO_2	174
32*	Silicon Dioxide (Fused)	SiO_2	183
33	Strontium Oxide	SrO	194
34*	Thorium Dioxide	ThO_2	195

*Number marked with an asterisk indicates that recommended values are also reported for this material on separate figure and table of the same number followed by the letter R.

2. SINGLE OXIDES (continued)

Figure and/or Table No.	Name	Formula	Page No.
35	Tin Dioxide	SnO_2	199
36*	Titanium Dioxide	TiO_2	202
37	Tungsten Trioxide	WO_3	209
38	Uranium Dioxide	UO_2	210
39	(tri)Uranium Octoxide	U_3O_8	237
40	Yttrium Oxide	Y_2O_3	240
41	Zinc Oxide	ZnO	243
42	Zirconium Dioxide	ZrO_2	246

3. OXIDE COMPOUNDS

43	Aluminum Fluosilicate (Topaz)	$2AlFO \cdot SiO_2$	251
44	Aluminum Silicate (Mullite)	$3Al_2O_3 \cdot 2SiO_2$	254
45	Barium Metatitanate	$BaTiO_3$	257
46	Barium Dititanate	$BaO \cdot 2TiO_2$	260
47	Bismuth Stannate	$Bi_2(SnO_3)_3$	261
48	Calcium Stannate	$CaSnO_3$	264
49	Calcium Metatitanate	$CaTiO_3$	267
50	Calcium Tungstate	$CaWO_4$	270
51	(tri)Cobalt Strontium Metatitanate	Co_3SrTiO_3	271
52	Cobalt Zinc Ferrate	$Co(Zn)Fe_2O_4$	272
53	Forsterite	Mg_2SiO_4	275
54	Garnet	$[M_3^{II}M_2^{III}(SiO_4)_3]$	278
55	Lead Metatitanate	$PbTiO_3$	279
56	Lead Zirconate	$PbZrO_3$	282
57	Magnesium Aluminate	$MgO \cdot Al_2O_3$	283
58	Magnesium Aluminate	$MgO \cdot 3.5Al_2O_3$	286
59	Magnesium Stannate	$MgSnO_3$	289
60	Manganese Ferrate	$MnFe_2O_4$	292
61	Manganese Zinc Ferrate	$Mn(Zn)Fe_2O_4$	295
62	Nickel Zinc Ferrate	$Ni(Zn)Fe_2O_4$	298
63	Sodium Tungsten Bronze	Na_xWO_3	301
64	Strontium Metatitanate	$SrTiO_3$	304
65	Strontium Zirconate	$SrZrO_3$	307
66	Yttrium Aluminate	$Y_3Al_5O_{12}$	308
67	Yttrium Ferrate	$Y_3Fe_2(FeO_4)_3$	311
68	Zinc Ferrate	$ZnFe_2O_4$	314
69	Zirconium Orthosilicate	$ZrSiO_4$	317

*Number marked with an asterisk indicates that recommended values are also reported for this material on separate figure and table of the same number followed by the letter R.

4. BINARY MIXTURES OF SINGLE OXIDES AND/OR OXIDE COMPOUNDS

Figure and/or Table No.	Name		Page No.
70	Aluminum Oxide + Aluminum Silicate	$Al_2O_3 + 3Al_2O_3 \cdot 2SiO_2$	321
71	Aluminum Oxide + (di)Chromium Trioxide	$Al_2O_3 + Cr_2O_3$	324
72	Aluminum Oxide + (di)Manganese Trioxide	$Al_2O_3 + Mn_2O_3$	327
73	Aluminum Oxide + Silicon Dioxide	$Al_2O_3 + SiO_2$	328
74	Aluminum Oxide + Zirconium Dioxide	$Al_2O_3 + ZrO_2$	331
75	Aluminum Silicate + Aluminum Oxide	$3Al_2O_3 \cdot 2SiO_2 + Al_2O_3$	334
76	Barium Oxide + Strontium Oxide	$BaO + SrO$	337
77	Barium Metatitanate + Calcium Metatitanate	$BaTiO_3 + CaTiO_3$	340
78	Barium Metatitanate + Magnesium Zirconate	$BaTiO_3 + MgZrO_3$	343
79	Barium Metatitanate + Manganese Niobate	$BaTiO_3 + Mn_2Nb_2O_7$	344
80	Beryllium Oxide + Uranium Dioxide	$BeO + UO_2$	347
81	Cerium Dioxide + Magnesium Oxide	$CeO_2 + MgO$	350
82	Cerium Dioxide + Uranium Dioxide	$CeO_2 + UO_2$	353
83	Gadolinium Oxide + Samarium Oxide	$Gd_2O_3 + Sm_2O_3$	356
84	Lead Oxide + Silicon Dioxide	$PbO + SiO_2$	359
85	Magnesium Aluminate + Magnesium Oxide	$MgO \cdot Al_2O_3 + MgO$	362
86	Magnesium Aluminate + Silicon Dioxide	$MgO \cdot Al_2O_3 + SiO_2$	365
87	Magnesium Aluminate + (di)Sodium Oxide	$MgO \cdot Al_2O_3 + Na_2O$	368
88	Magnesium Oxide + Beryllium Oxide	$MgO + BeO$	371
89	Magnesium Oxide + Clay	MgO + Clay	374
90	Magnesium Oxide + Magnesium Aluminate	$MgO + MgO \cdot Al_2O_3$	375
91	Magnesium Oxide + Magnesium Orthosilicate	$MgO + 2MgO \cdot SiO_2$	378
92	Magnesium Oxide + Nickel Oxide	$MgO + NiO$	381
93	Magnesium Oxide + Silicon Dioxide	$MgO + SiO_2$	384
94	Magnesium Oxide + Tin Dioxide	$MgO + SnO_2$	387
95	Magnesium Oxide + Uranium Dioxide	$MgO + UO_2$	390
96	Magnesium Oxide + Zinc Oxide	$MgO + ZnO$	391
97	Magnesium Orthosilicate + Magnesium Oxide	$2MgO \cdot SiO_2 + MgO$	394
98	(di)Manganese Trioxide + Aluminum Oxide	$Mn_2O_3 + Al_2O_3$	397
99	(di)Manganese Trioxide + Magnesium Oxide	$Mn_2O_3 + MgO$	398
100	(di)Manganese Trioxide + Silicon Dioxide	$Mn_2O_3 + SiO_2$	399
101	Silicon Dioxide + Aluminum Oxide	$SiO_2 + Al_2O_3$	402
102	Silicon Dioxide + Calcium Oxide	$SiO_2 + CaO$	407
103	Silicon Dioxide + (di)Iron Trioxide	$SiO_2 + Fe_2O_3$	410
104	Thorium Dioxide + Uranium Dioxide	$ThO_2 + UO_2$	413
105	Tin Dioxide + Magnesium Oxide	$SnO_2 + MgO$	416
106	Tin Dioxide + Zinc Oxide	$SnO_2 + ZnO$	419
107	Tungsten Trioxide + Zinc Oxide	$WO_3 + ZnO$	422
108	Uranium Dioxide + Beryllium Oxide	$UO_2 + BeO$	423
109	Uranium Dioxide + Calcium Oxide	$UO_2 + CaO$	426
110	Uranium Dioxide + (di)Niobium Pentoxide	$UO_2 + Nb_2O_5$	427
111	Uranium Dioxide + Yttrium Oxide	$UO_2 + Y_2O_3$	428
112	Uranium Dioxide + Zirconium Dioxide	$UO_2 + ZrO_2$	429
113	Yttrium Oxide + Uranium Dioxide	$Y_2O_3 + UO_2$	432
114	Zinc Oxide + Magnesium Oxide	$ZnO + MgO$	435
115	Zinc Oxide + Tin Dioxide	$ZnO + SnO_2$	438

4. BINARY MIXTURES OF SINGLE OXIDE AND/OR OXIDE COMPOUNDS (continued)

Figure and/or Table No.	Name	Formula	Page No.
116	Zirconium Dioxide + Aluminum Oxide	$ZrO_2 + Al_2O_3$	441
117	Zirconium Dioxide + Calcium Oxide	$ZrO_2 + CaO$	442
118	Zirconium Dioxide + Magnesium Oxide	$ZrO_2 + MgO$	446
119	Zirconium Dioxide + Yttrium Oxide	$ZrO_2 + Y_2O_3$	449

5. MULTIPLE MIXTURES OF SINGLE OXIDES AND/OR OXIDE COMPOUNDS

120	Aluminum Oxide + Silicon Dioxide + ΣX_i	$Al_2O_3 + SiO_2 + \Sigma X_i$	453
121	Aluminum Oxide + Titanium Dioxide + ΣX_i	$Al_2O_3 + TiO_2 + \Sigma X_i$	456
122	Barium Oxide + Silicon Dioxide + ΣX_i	$BaO + SiO_2 + \Sigma X_i$	457
123	Barium Oxide + Strontium Oxide + ΣX_i	$BaO + SrO + \Sigma X_i$	460
124	Beryllium Oxide + Aluminum Oxide + ΣX_i	$BeO + Al_2O_3 + \Sigma X_i$	461
125	Beryllium Oxide + Magnesium Oxide + ΣX_i	$BeO + MgO + \Sigma X_i$	464
126	Beryllium Oxide + Thorium Dioxide + ΣX_i	$BeO + ThO_2 + \Sigma X_i$	467
127	Beryllium Oxide + Zirconium Dioxide + ΣX_i	$BeO + ZrO_2 + \Sigma X_i$	470
128	(di)Chromium Trioxide + Magnesium Oxide + ΣX_i	$Cr_2O_3 + MgO + \Sigma X_i$	473
129	Lead Oxide + Silicon Dioxide + ΣX_i	$PbO + SiO_2 + \Sigma X_i$	474
130	Magnesium Oxide + Calcium Oxide + ΣX_i	$MgO + CaO + \Sigma X_i$	477
131	Magnesium Oxide + (di)Chromium Trioxide + ΣX_i	$MgO + Cr_2O_3 + \Sigma X_i$	480
132	Magnesium Oxide + (di)Iron Trioxide + ΣX_i	$MgO + Fe_2O_3 + \Sigma X_i$	483
133	Magnesium Oxide + Silicon Dioxide + ΣX_i	$MgO + SiO_2 + \Sigma X_i$	484
134	Silicon Dioxide + Aluminum Oxide + ΣX_i	$SiO_2 + Al_2O_3 + \Sigma X_i$	487
135	Silicon Dioxide + Barium Oxide + ΣX_i	$SiO_2 + BaO + \Sigma X_i$	495
136	Silicon Dioxide + Boron Oxide + ΣX_i	$SiO_2 + B_2O_3 + \Sigma X_i$	498
137	Silicon Dioxide + Calcium Oxide + ΣX_i	$SiO_2 + CaO + \Sigma X_i$	501
138	Silicon Dioxide + Lead Oxide + ΣX_i	$SiO_2 + PbO + \Sigma X_i$	504
139	Silicon Dioxide + (di)Potassium Oxide + ΣX_i	$SiO_2 + K_2O + \Sigma X_i$	507
140	Silicon Dioxide + (di)Sodium Oxide + ΣX_i	$SiO_2 + Na_2O + \Sigma X_i$	510
141	Strontium Oxide + Lithium Aluminate + ΣX_i	$SrO + Li_2O \cdot Al_2O_3 + \Sigma X_i$	513
142	Strontium Oxide + Lithium Zirconium Silicate + ΣX_i	$SrO + Li_2O \cdot ZrO \cdot SiO_2 + \Sigma X_i$	514
143	Strontium Oxide + Titanium Dioxide + ΣX_i	$SrO + TiO_2 + \Sigma X_i$	517
144	Strontium Oxide + Zinc Oxide + ΣX_i	$SrO + ZnO + \Sigma X_i$	520
145	Tin Dioxide + Magnesium Oxide + ΣX_i	$SnO_2 + MgO + \Sigma X_i$	523
146	Tin Dioxide + Zinc Oxide + ΣX_i	$SnO_2 + ZnO + \Sigma X_i$	524
147	Zinc Oxide + Strontium Oxide + ΣX_i	$ZnO + SrO + \Sigma X_i$	527
148	Zinc Oxide + Tin Dioxide + ΣX_i	$ZnO + SnO_2 + \Sigma X_i$	528
149	Zirconium Dioxide + Calcium Oxide + ΣX_i	$ZrO_2 + CaO + \Sigma X_i$	531
150	Zirconium Dioxide + Silicon Dioxide + ΣX_i	$ZrO_2 + SiO_2 + \Sigma X_i$	534
151	Zirconium Dioxide + Yttrium Oxide + ΣX_i	$ZrO_2 + Y_2O_3 + \Sigma X_i$	537

6. MIXTURES OF OXIDE AND NONOXIDE

Figure and/or Table No.	Name	Formula	Page No.
152	(tetra)Boron Carbide + Sodium Metasilicate	$B_4C + Na_2O \cdot SiO_2$	541
153	Graphite + Thorium Dioxide	$C + ThO_2$	544
154	Graphite + Uranium Dioxide	$C + UO_2$	547
155	Magnesium Oxide + Talc	$MgO + H_2Mg_3(SiO_3)_4$	550
156	Silicon Carbide + Silicon Dioxide	$SiC + SiO_2$	553
157	Silicon Carbide + Silicon Dioxide + ΣX_i	$SiC + SiO_2 + \Sigma X_i$	554
158	Thorium Dioxide + Graphite	$ThO_2 + C$	557

7. IODIDE

159	Cesium Iodide	CsI	561
160	Copper Iodide	CuI	562
161	Silver Iodide	AgI	563

8. BROMIDES

162	Cesium Bromide	CsBr	565
163	Potassium Bromide	KBr	566
164	Silver Bromide	AgBr	569
165	Thallium Bromide	TlBr	570

9. CARBIDES

166	(di)Beryllium Carbide	Be_2C	571
167	(tetra)Boron Carbide	B_4C	572
168	Hafnium Carbide	HfC	575
169	(tri)Iron Carbide	Fe_3C	578
170	(di)Molybdenum Carbide	Mo_2C	579
171	Niobium Carbide	NbC	582
172	Silicon Carbide	SiC	585
173	Tantalum Carbide	TaC	589
174	Thorium Carbide	ThC	592
175	Thorium Dicarbide	ThC_2	593
176	Titanium Carbide	TiC	594
177	Tungsten Carbide	WC	598
178	Uranium Carbide	UC	601
179	Uranium Dicarbide	UC_2	605
180	Vanadium Carbide	VC	606
181	Zirconium Carbide	ZrC	609

10. CHLORIDES

Figure and/or Table No.	Name	Formula	Page No.
182	Potassium Chloride	KCl	613
183	Silver Chloride	$AgCl$	620
184	Sodium Chloride	$NaCl$	621
185	Thallium Chloride	$TlCl$	625
186	Zinc Dichloride	$ZnCl_2$	626

11. FLUORIDES AND THEIR MIXTURES

187	Barium Difluoride	BaF_2	627
188	Calcium Difluoride	CaF_2	630
189	Lanthanum Trifluoride	LaF_3	633
190	Lithium Fluoride	LiF	636
191	Lithium Fluoride + Potassium Fluoride + ΣX_i	$LiF + KF + \Sigma X_i$	641
192	Sodium Fluoride	NaF	642
193	Sodium Fluoride + Beryllium Difluoride	$NaF + BeF_2$	645
194	Sodium Fluoride + Zirconium Tetrafluoride + ΣX_i	$NaF + ZrF_4 + \Sigma X_i$	646

12. NITRATES

195	Potassium Nitrate	KNO_3	647
196	Silver Nitrate	$AgNO_3$	650
197	Sodium Nitrate	$NaNO_3$	651

13. NITRIDES

198	Aluminum Nitride	AlN	653
199	Boron Nitride	BN	656
200	Hafnium Nitride	HfN	659
201	(tri)Silicon Tetranitride	Si_3N_4	662
202	Tantalum Nitride	TaN	665
203	Titanium Nitride	TiN	668
204	Uranium Nitride	UN	672
205	Zirconium Nitride	ZrN	675

14. PHOSPHATES

206	Ammonium Dihydrogen Phosphate	$NH_4H_2PO_4$	679
207	Potassium Dideuteron Phosphate	KD_2PO_4	680
208	Potassium Dihydrogen Phosphate	KH_2PO_4	683

15. SULFATES

Figure and/or Table No.	Name	Formula	Page No.
209	Ammonium Hydrogen Sulfate	NH_4HSO_4	687
210	Potassium Chromium Sulfate (Alum)	$KCr(SO_4)_2 \cdot 12H_2O$	688
211	Potassium Hydrogen Sulfate	$KHSO_4$	691
212	Sodium Hydrogen Sulfate	$NaHSO_4$	692
213	Sodium Thiosulfate	$Na_2S_2O_3 \cdot 5H_2O$	693
214	Zinc Sulfate Heptahydrate	$ZnSO_4 \cdot 7H_2O$	694

16. SULFIDES AND THEIR MIXTURES

215	Cerium Sulfide	CeS	697
216	(di)Cerium Trisulfide	Ce_2S_3	698
217	(di)Copper Sulfide	Cu_2S	699
218	(di)Copper Sulfide + Iron Sulfide + (tri)Nickel Disulfide	$Cu_2S + FeS + Ni_3S_2$	700
219	(di)Copper Sulfide + (tri)Nickel Disulfide	$Cu_2S + Ni_3S_2$	701
220	Lanthanum Sulfide	LaS	702
221	(tri)Nickel Disulfide	Ni_3S_2	705

17. CERMETS

222	Aluminum Oxide + Chromium	$Al_2O_3 + Cr$	707
223	Beryllium Oxide + Beryllium	BeO + Be	708
224	Beryllium Oxide + Beryllium + Molybdenum	BeO + Be + Mo	711
225	Beryllium Oxide + Beryllium + Silicon	BeO + Be + Si	714
226	(tetra)Boron Carbide + Aluminum	$B_4C + Al$	717
227	Silicon Carbide + Silicon	SiC + Si	718
228	(di)Sodium Oxide + Sodium	$Na_2O + Na$	721
229	Strontium Metatitanate + Cobalt	$SrTiO_3 + Co$	722
230	Titanium Carbide + Cobalt	TiC + Co	725
231	Titanium Carbide + Cobalt + Niobium Carbide	TiC + Co + NbC	726
232	Titanium Carbide + Nickel + Molybdenum + Niobium Carbide	TiC + Ni + Mo + NbC	727
233	Titanium Carbide + Nickel + Niobium Carbide	TiC + Ni + NbC	730
234	Uranium Carbide + Uranium	UC + U	731
235	Uranium Dioxide + Chromium	$UO_2 + Cr$	732
236	Uranium Dioxide + Molybdenum	$UO_2 + Mo$	735
237	Uranium Dioxide + Niobium	$UO_2 + Nb$	738
238	Uranium Dioxide + Stainless Steel	UO_2 + Stainless Steel	741
239	Uranium Dioxide + Uranium	$UO_2 + U$	744
240	Uranium Dioxide + Zirconium	$UO_2 + Zr$	746
241	Zirconium Dioxide + Titanium	$ZrO_2 + Ti$	749
242	Zirconium Dioxide + Zirconium	$ZrO_2 + Zr$	752
243	Zirconium Dioxide + Yttrium Oxide + Zirconium	$ZrO_2 + Y_2O_3 + Zr$	753

18. MISCELLANEOUS INORGANIC COMPOUNDS AND MIXTURES

Figure and/or Table No.	Name	Formula	Page No.
244	Ammonium Perchlorate	NH_4ClO_4	757
245	Cadmium Germanium Phosphide	$CdGeP_2$	758
246	Calcium Carbonate	$CaCO_3$	759
247	Calcium Phosphate + Lithium Carbonate + Magnesium Carbonate	$Ca_3(PO_4)_2 + Li_2CO_3 + MgCO_3$	763
248	Carbon + Oxygen	C + O	764
249	Carbon + Volatile Materials	C + Volatile Materials	765
250	Gallium Phosphide	GaP	766
251	Graphite + Bromine	C + Br	767
252	Graphite + Uranium Dicarbide	$C + UC_2$	770
253	Lithium Hydride	LiH	773
254	Magnesium Carbonate	$MgCO_3$	776
255	Potassium Bromide + Potassium Chloride	KBr + KCl	779
256	Potassium Chloride + Potassium Bromide	KCl + KBr	782
257	Potassium Dihydrogen Arsenate	KH_2AsO_4	785
258	Potassium Thiocyanate	KSCN	788
259	Silicon Carbide + Graphite	SiC + C	789
260	Sodium Hydroxide	NaOH	790
261	Strontium Difluoride + ΣX_i	$SrF_2 + \Sigma X_i$	791
262	Zinc Germanium Phosphide	$ZnGeP_2$	792
263	Zirconium Hydride	ZrH	793

19. MINERALS

264	Basalt	797
265	Beryl	800
266	Clay	803
267	Coal	807
268	Dolomite	810
269	Earth	813
270	Gabbro	816
271	Granite	817
272	Limestone	820
273	Mica	823
274	Perlite	827
275	Rock	828
276	Salt	832
277	Sand	833
278	Sandstone	840
279	Sillimanite	845
280	Slate	846
281	Soil	847
282	Spinel	848
283	Spodumene	851
284	Steatite	852
285	Tourmaline	855

19. MINERALS (continued)

Figure and/or Table No.	Name	Page No.
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287	Wollastonite	859

20. AGGREGATE MIXES

288	Cement	861
289	Concrete	862
290	Plaster	887

21. MISCELLANEOUS REFRACTORY MATERIALS AND GLASSES

291	Bricks	889
292	Ceramics, Miscellaneous	915
293	Cordierite	918
294	Enamel	921
295*	Glasses	922
296	Mullite	934
297	Petalite	935
298	Porcelains	936
299*	Pyroceram Brand Glass - Ceramic	939

22. POLYMERS

300	Copoly(chloroethylene-vinyl acetate)	943
301	Copoly(formaldehyde-urea), Mipora	944
302	Nylon	945
303	Phenolic Resin	949
304	Pliofoam	950
305	Polychloroethylene(polyvinyl chloride)	953
306	Polyethylene	956
307	Polyhexahydro-2H-azepin-2-one, Silon	959
308	Poly(methyl methacrylate) [Plexiglas]	960
309	Polystyrene	963
310	Polytetrafluoroethylene [Teflon]	967
311	Polytrifluorochloroethylene	970
312	Rubber (Ebonite)	971
313	Rubber (Elastomer)	974
314	Rubber (GR-S)	977
315	Rubber (Miscellaneous)	980

*Number marked with an asterisk indicates that recommended values are also reported for this material on separate figure and table of the same number followed by the letter R.

23. MISCELLANEOUS ORGANIC COMPOUNDS

Figure and/or Table No.	Name	Formula	Page No.
316	Anthracene	$[C_6H_4(CH)_2C_6H_4]$	985
317	Benzene, P-dibromo	$C_6H_4Br_2$	986
318	Benzene, P-dichloro	$C_6H_4Cl_2$	987
319	Benzene, P-diiodo	$C_6H_4I_2$	988
320	Diphenyl	$C_6H_5C_6H_5$	989
321	Diphenyl Oxide	$(C_6H_5)_2O$	990
322	Diphenylamine	$(C_6H_5)_2NH$	991
323	Diphenylmethane + Naphthalene	$(C_6H_5)_2CH_2 + C_{10}H_8$	994
324	Naphthalene	$C_{10}H_8$	995
325	Naphthol	$C_{10}H_7OH$	998
326	Nitrophenol	$NO_2C_6H_4OH$	1001
327	Phenanthren	$C_{14}H_{10}$	1004
328	Santowax R		1005
329	Sodium Acetate	$NaC_2H_3O_2 \cdot 3H_2O$	1006
330	Trinitrotoluene	$CH_3C_6H_2(NO_2)_3$	1007

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334	Laminates (Nonmetallic)	1021
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345	Cork	1063
346	Cotton	1068
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349	Greenheart	1074
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355	Maple	1081
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365	Wood Fiber	1091
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369	Hair Felt	1099
370	Pluton Cloth	1100
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374	Asphalt - Glass Wool Pad	1108
375	Cardboard	1109
376	Cellulose Fiberboard	1110
377	Cornstalk Wallboard	1111
378	Diatomite Aggregate	1112
379	Excelsior	1113
380	Fir Plywood	1114
381	Glass Fiber Blanket [Fiberglass]	1115
382	Glass Fiber Board	1124
383	Koldboard	1125
384	Monolithic Wall	1126
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386	Sea-weed Product	1128
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388	Wallboards, Miscellaneous	1131
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392	Micanite	1138
393	Mineral Fiber	1139
394	Processed Mineral Wool	1140
395	Quartz Fiber	1143
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VOLUME 3. THERMAL CONDUCTIVITY - NONMETALLIC LIQUIDS AND GASES

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MATERIAL INDEX

MATERIAL INDEX TO THERMAL CONDUCTIVITY COMPANION VOLUMES 1, 2, and 3 A1

GROUPING OF MATERIALS AND LIST OF FIGURES AND TABLES

1. ELEMENTS

Figure and/or Table No.	Name	Symbol	Physical State*	Page No.
1	Argon	A	S, L, V, G	1
2	Bromine	Br_2	-, L, V, G	13
3	Chlorine	Cl_2	-, L, V, G	17
4	Deuterium	D_2	-, L, V, G	21
5	Fluorine	F_2	-, L, V, G	26
6	Helium	He	S, L, V, G	29
7	Hydrogen	H_2	S, L, V, G	41
8	Krypton	Kr	S, L, V, G	50
9	Neon	Ne	S, L, V, G	56
10	Nitrogen	N_2	S, L, V, G	64
11	Oxygen	O_2	-, L, V, G	76
12	Radon	Rn	-, L, V, G	84
13	Tritium	T_2	-, L, -, -	87
14	Xenon	Xe	S, L, V, G	88

2. INORGANIC COMPOUNDS

15	Ammonia	NH_3	-, L, G, -	95
16	Boron Trifluoride	BF_3	-, -, G, -	99
17	Hydrogen Chloride	HCl	-, -, G, -	101
18	Hydrogen Iodide	HI	-, -, G, -	103
19	Hydrogen Sulfide	H_2S	-, -, G, -	104
20	Nitric Oxide	NO	-, -, G, -	106
21	Nitrogen Peroxide	NO_2	-, L, G, -	108
22	Nitrous Oxide	N_2O	-, -, G, -	114
23	Sulfur Dioxide	SO_2	-, L, G, -	116
24	Water	H_2O	-, L, G, -	120

3. ORGANIC COMPOUNDS

25	Acetone	$(CH_3)_2CO$	-, L, G, -	129
26	Acetylene	CHCH	-, -, G, -	133
27	Benzene	C_6H_6	-, L, G, -	135
28	i-Butane	i-C_4H_{10}	-, -, G, -	139
29	n-Butane	n-C_4H_{10}	-, L, G, -	141
30	Carbon Dioxide	CO_2	-, L, G, -	145

*S = solid, L = saturated liquid, V = saturated vapor, G = gas.

3. ORGANIC COMPOUNDS (continued)

Figure and/or Table No.	Name	Formula	Physical State*	Page No.
31	Carbon Monoxide	CO	L, G	151
32	Carbon Tetrachloride	CCl_4	L, G	156
33	Chloroform	$CHCl_3$	L, G	161
34	n-Decane	$C_{10}H_{22}$	L, G	164
35	Ethane	C_2H_6	-, G	167
36	Ethyl Alcohol	C_2H_5OH	L, G	169
37	Ethylene	CH_2CH_2	L, G	173
38	Ethylene Glycol	CH_2OHCH_2OH	L, -	177
39	Ethyl Ether	$(C_2H_5)_2O$	L, G	179
40	Freon 11	Cl_3CF	L, G	183
41	Freon 12	Cl_2CF_2	L, G	187
42	Freon 13	$ClCF_3$	-, G	191
43	Freon 21	Cl_2CHF	L, G	193
44	Freon 22	$ClCHF_2$	L, G	197
45	Freon 113	CCl_2FCClF_2	L, G	201
46	Freon 114	$CClF_2CClF_2$	L, G	205
47	Glycerol	$CH_2OHCHOHCH_2OH$	L, -	209
48	n-Heptane	C_7H_{16}	L, G	211
49	n-Hexane	C_6H_{14}	L, G	214
50	Methane	CH_4	L, G	218
51	Methyl Alcohol	CH_3OH	L, G	223
52	Methyl Chloride	CH_3Cl	L, G	227
53	n-Nonane	C_9H_{20}	L, G	230
54	n-Octane	C_8H_{18}	L, G	233
55	n-Pentane	C_5H_{12}	L, G	236
56	Propane	C_3H_8	-, G	240
57	Toluene	$C_6H_5CH_3$	L, G	242

4. BINARY SYSTEMS

A. Monatomic - Monatomic Systems

58	Argon and Helium	Ar and He	-, G	251
59	Argon and Neon	Ar and Ne	-, G	258
60	Argon and Krypton	Ar and Kr	-, G	263
61	Argon and Xenon	Ar and Xe	-, G	267
62	Helium and Neon	He and Ne	-, G	271
63	Helium and Krypton	He and Kr	-, G	276
64	Helium and Xenon	He and Xe	-, G	280
65	Krypton and Neon	Kr and Ne	-, G	284
66	Krypton and Xenon	Kr and Xe	-, G	288
67	Neon and Xenon	Ne and Xe	-, G	291

* L = saturated liquid, G = gas.

4. BINARY SYSTEMS (continued)

B. Monatomic - Nonpolar Polyatomic Systems

Figure and/or Table No.	Name	Formula	Physical State*	Page No.
68	Argon and Benzene	Ar and C_6H_6	G	295
69	Argon and Carbon Dioxide	Ar and CO_2	G	297
70	Argon and Deuterium	Ar and D_2	G	299
71	Argon and Hydrogen	Ar and H_2	G	301
72	Argon and Methane	Ar and CH_4	G	304
73	Argon and Nitrogen	Ar and N_2	G	306
74	Argon and Oxygen	Ar and O_2	G	311
75	Argon and Propane	Ar and C_3H_8	G	316
76	Helium and Air	He and Air	G	318
77	Helium and n-Butane	He and C_4H_{10}	G	320
78	Helium and Carbon Dioxide	He and CO_2	G	322
79	Helium and Cyclopropane	He and C_3H_6	G	325
80	Helium and Deuterium	He and D_2	G	327
81	Helium and Ethane	He and C_2H_6	G	329
82	Helium and Ethylene	He and C_2H_4	G	331
83	Helium and Hydrogen	He and H_2	G	333
84	Helium and Methane	He and CH_4	G	338
85	Helium and Nitrogen	He and N_2	G	340
86	Helium and Oxygen	He and O_2	G	343
87	Helium and Propane	He and C_3H_8	G	345
88	Helium and Propylene	He and C_3H_6	G	347
89	Krypton and Deuterium	Kr and D_2	G	349
90	Krypton and Hydrogen	Kr and H_2	G	351
91	Krypton and Nitrogen	Kr and N_2	G	354
92	Krypton and Oxygen	Kr and O_2	G	356
93	Neon and Carbon Dioxide	Ne and CO_2	G	358
94	Neon and Deuterium	Ne and D_2	G	360
95	Neon and Hydrogen	Ne and H_2	G	362
96	Neon and Nitrogen	Ne and N_2	G	365
97	Neon and Oxygen	Ne and O_2	G	368
98	Xenon and Deuterium	Xe and D_2	G	371
99	Xenon and Hydrogen	Xe and H_2	G	374
100	Xenon and Nitrogen	Xe and N_2	G	377
101	Xenon and Oxygen	Xe and O_2	G	379

C. Nonpolar Polyatomic - Nonpolar Polyatomic Systems

102	Acetylene and Air	C_2H_2 and Air	G	381
103	Air and Carbon Monoxide	Air and CO	G	383
104	Air and Methane	Air and CH_4	G	385
105	Benzene and Hexane	C_6H_6 and C_6H_{14}	G	387
106	Carbon Dioxide and Ethylene	CO_2 and C_2H_4	G	389
107	Carbon Dioxide and Hydrogen	CO_2 and H_2	G	391
108	Carbon Dioxide and Nitrogen	CO_2 and N_2	G	396
109	Carbon Dioxide and Oxygen	CO_2 and O_2	G	401
110	Carbon Dioxide and Propane	CO_2 and C_3H_8	G	403

*G = gas.

4. BINARY SYSTEMS (continued)

C. Nonpolar Polyatomic - Nonpolar Polyatomic Systems (continued)

Figure and/or Table No.	Name	Formula	Physical State*	Page No.
111	Carbon Monoxide and Hydrogen	CO and H_2	G	405
112	Deuterium and Hydrogen	D_2 and H_2	G	407
113	Deuterium and Nitrogen	D_2 and N_2	G	410
114	Ethylene and Hydrogen	C_2H_4 and H_2	G	413
115	Ethylene and Methane	C_2H_4 and CH_4	G	415
116	Ethylene and Nitrogen	C_2H_4 and N_2	G	417
117	Hydrogen and Nitrogen	H_2 and N_2	G	419
118	Hydrogen and Nitrous Oxide	H_2 and N_2O	G	427
119	Hydrogen and Oxygen	H_2 and O_2	G	429
120	Methane and Propane	CH_4 and C_3H_8	G	432
121	Nitrogen and Oxygen	N_2 and O_2	G	434
122	Nitrogen and Propane	N_2 and C_3H_8	G	438

D. Polar - Nonpolar Polyatomic Systems

123	Acetone and Benzene	C_3H_6O and C_6H_6	G	440
124	Ammonia and Air	NH_3 and Air	G	442
125	Ammonia and Carbon Monoxide	NH_3 and CO	G	444
126	Ammonia and Ethylene	NH_3 and C_2H_4	G	446
127	Ammonia and Hydrogen	NH_3 and H_2	G	448
128	Ammonia and Nitrogen	NH_3 and N_2	G	451
129	Ethanol and Argon	C_2H_6O and Ar	G	454
130	Ethanol and Propane	C_2H_6O and C_3H_8	G	456
131	Methanol and Argon	CH_4O and Ar	G	458
132	Methanol and Hexane	CH_4O and C_6H_{14}	G	460
133	Methyl Formate and Propane	$C_2H_4O_2$ and C_3H_8	G	462
134	Steam and Air	H_2O and Air	G	464
135	Steam and Carbon Dioxide	H_2O and CO_2	G	466
136	Steam and Nitrogen	H_2O and N_2	G	468

E. Polar - Polar Systems

137	Chloroform and Ethyl Ether	$CHCl_3$ and $C_4H_{10}O$	G	470
138	Diethylamine and Ethyl Ether	$C_4H_{10}NH$ and $C_4H_{10}O$	G	472
139	Ethanol and Methyl Formate	C_2H_6O and $C_2H_4O_2$	G	474

5. TERNARY SYSTEMS

A. Monatomic Systems

140	Neon-Argon-Krypton	Ne-Ar-Kr	G	478
141	Helium-Argon-Xenon	He-Ar-Xe	G	479
142	Helium-Krypton-Xenon	He-Kr-Xe	G	480
143	Helium-Argon-Krypton	He-Ar-Kr	G	481
144	Helium-Neon-Xenon	He-Ne-Xe	G	482
145	Argon-Krypton-Xenon	Ar-Kr-Xe	G	483

*G = gas.

5. TERNARY SYSTEMS (continued)

B. Monatomic and Nonpolar Polyatomic Systems

Figure and/or Table No.	Name	Formula	Physical State*	Page No.
146	Helium-Oxygen-Methane	$He-O_2-CH_4$	G	484
147	Argon-Oxygen-Methane	$Ar-O_2-CH_4$	G	485
148	Helium-Argon-Nitrogen	$He-Ar-N_2$	G	486
149	Helium-Nitrogen-Methane	$He-N_2-CH_4$	G	487
150	Argon-Krypton-Deuterium	$Ar-Kr-D_2$	G	488
151	Helium-Neon-Deuterium	$He-Ne-D_2$	G	489
152	Neon-Argon-Deuterium	$Ne-Ar-D_2$	G	490
153	Neon-Krypton-Deuterium	$Ne-Kr-D_2$	G	491
154	Neon-Hydrogen-Oxygen	$Ne-H_2-O_2$	G	492
155	Argon-Hydrogen-Nitrogen	$Ar-H_2-N_2$	G	493
156	Neon-Hydrogen-Nitrogen	$Ne-H_2-N_2$	G	494
157	Neon-Nitrogen-Oxygen	$Ne-N_2-O_2$	G	495
158	Argon-Krypton-Hydrogen	$Ar-Kr-H_2$	G	496

C. Nonpolar Polyatomic Systems

159	Nitrogen-Oxygen-Carbon Dioxide	$N_2-O_2-CO_2$	G	497
160	Hydrogen-Nitrogen-Oxygen	$H_2-N_2-O_2$	G	498

D. Nonpolar and Polar Systems

161	Argon-Propane-Ethanol	$Ar-C_3H_8-C_2H_6O$	G	499
162	Hydrogen-Nitrogen-Ammonia	$H_2-N_2-NH_3$	G	500

6. QUATERNARY SYSTEMS

A. Monatomic Systems

163	Neon-Argon-Krypton-Xenon	Ne-Ar-Kr-Xe	G	504

B. Monatomic and Nonpolar Polyatomic Systems

164	Argon-Krypton-Xenon-Hydrogen	$Ar-Kr-Xe-H_2$	G	505
165	Argon-Krypton-Xenon-Deuterium	$Ar-Kr-Xe-D_2$	G	506
166	Argon-Hydrogen-Deuterium-Nitrogen	$Ar-H_2-D_2-N_2$	G	507
167	Argon-Hydrogen-Nitrogen-Oxygen	$Ar-H_2-N_2-O_2$	G	508
168	Neon-Argon-Hydrogen-Nitrogen	$Ne-Ar-H_2-N_2$	G	509
169	Argon-Xenon-Hydrogen-Deuterium	$Ar-Xe-H_2-D_2$	G	510

7. MULTICOMPONENT SYSTEMS

170	Air		G	512

*G = gas.

VOLUME 4. SPECIFIC HEAT - METALLIC ELEMENTS AND ALLOYS

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GROUPING OF MATERIALS AND LIST OF FIGURES AND TABLES

1. ELEMENTS

Figure and/or Table No.	Name	Symbol	Page No.
1	Aluminum	Al	1
2	Antimony	Sb	6
3	Arsenic	As	9
4	Barium	Ba	13
5	Beryllium	Be	16
6	Bismuth	Bi	21
7	Boron	B	25
8	Cadmium	Cd	29
9	Calcium	Ca	32
10	Cerium	Ce	36
11	Cesium	Cs	40
12	Chromium	Cr	44
13	Cobalt	Co	48
14	Copper	Cu	51
15	Dysprosium	Dy	62
16	Erbium	Er	65
17	Europium	Eu	68
18	Gadolinium	Gd	72
19	Gallium	Ga	75
20	Germanium	Ge	79
21	Gold	Au	83
22	Hafnium	Hf	87
23	Holmium	Ho	90
24	Indium	In	95
25	Iridium	Ir	99
26	Iron	Fe	102
27	Lanthanum	La	110
28	Lead	Pb	113
29	Lithium	Li	117
30	Lutetium	Lu	121
31	Magnesium	Mg	124
32	Manganese	Mn	127
33	Mercury	Hg	131
34	Molybdenum	Mo	135
35	Neodymium	Nd	140
36	Neptunium	Np	143
37	Nickel	Ni	146
38	Niobium	Nb	153
39	Osmium	Os	157
40	Palladium	Pd	160

1. ELEMENTS (continued)

Figure and/or Table No.	Name	Symbol	Page No.
41	Platinum	Pt	163
42	Plutonium	Pu	167
43	Potassium	K	171
44	Praseodymium	Pr	177
45	Rhenium	Re	181
46	Rhodium	Rh	184
47	Rubidium	Rb	187
48	Ruthenium	Ru	190
49	Samarium	Sm	193
50	Scandium	Sc	198
51	Selenium	Se	201
52	Silicon	Si	204
53	Silver	Ag	208
54	Sodium	Na	213
55	Strontium	Sr	218
56	Tantalum	Ta	221
57	Tellurium	Te	229
58	Terbium	Tb	232
59	Thallium	Tl	237
60	Thorium	Th	242
61	Thulium	Tm	245
62	Tin	Sn	249
63	Titanium	Ti	257
64	Tungsten	W	263
65	Uranium	U	268
66	Vanadium	V	271
67	Ytterbium	Yb	274
68	Yttrium	Y	278
69	Zinc	Zn	281
70	Zirconium	Zr	287

2. NONFERROUS BINARY ALLOYS

Figure and/or Table No.	Name	Formula	Page No.
71	Bismuth + Lead	Bi + Pb	291
72	Cadmium + Magnesium, MgCd	Mg + Cd	294
73	Cadmium + Magnesium, Mg_3Cd	Mg_3 + Cd	297
74	Cadmium + Magnesium, $MgCd_3$	Mg + Cd_3	300
75	Chromium + Aluminum	Cr + Al	304
76	Chromium + Iron	Cr + Fe	307
77	Chromium + Manganese	Cr + Mn	311
78	Cobalt + Dysprosium	Co + Dy	314
79	Cobalt + Iron	Co + Fe	317
80	Cobalt + Nickel	Co + Ni	320
81	Copper + Aluminum	Cu + Al	323

2. NONFERROUS BINARY ALLOYS (continued)

Figure and/or Table No.	Name	Formula	Page No.
82	Copper + Gallium	Cu + Ga	327
83	Copper + Iron	Cu + Fe	331
84	Copper + Magnesium	Cu + Mg	335
85	Copper + Manganese	Cu + Mn	338
86	Copper + Nickel	Cu + Ni	341
87	Copper + Zinc	Cu + Zn	346
88	Gold + Nickel	Au + Ni	353
89	Hafnium + Zirconium	Hf + Zr	356
90	Indium + Tin	In + Sn	359
91	Lead + Tin	Pb + Sn	362
92	Lithium + Magnesium	Li + Mg	366
93	Magnesium + Silicon	Mg + Si	369
94	Manganese + Aluminum	Mn + Al	372
95	Manganese + Copper	Mn + Cu	377
96	Manganese + Nickel	Mn + Ni	380
97	Molybdenum + Titanium	Mo + Ti	383
98	Molybdenum + Tungsten	Mo + W	386
99	Nickel + Aluminum	Ni + Al	389
100	Nickel + Chromium	Ni + Cr	392
101	Nickel + Copper	Ni + Cu	398
102	Nickel + Iron	Ni + Fe	403
103	Nickel + Magnesium	Ni + Mg	407
104	Nickel + Manganese	Ni + Mn	410
105	Nickel + Silicon	Ni + Si	413
106	Nickel + Tungsten	Ni + W	416
107	Nickel + Zinc	Ni + Zn	419
108	Niobium + Zirconium	Nb + Zr	422
109	Palladium + Silver	Pd + Ag	425
110	Potassium + Sodium	K + Na	428
111	Sodium + Potassium	Na + K	431
112	Tantalum + Tungsten	Ta + W	434
113	Thallium + Lead, $PbTl_2$	Tl + Pb	437
114	Tin + Bismuth	Sn + Bi	440
115	Tin + Indium	Sn + In	443
116	Tin + Lead	Sn + Pb	446
117	Tin + Magnesium	Sn + Mg	449
118	Titanium + Manganese	Ti + Mn	453
119	Titanium + Molybdenum	Ti + Mo	456
120	Tungsten + Cobalt	W + Co	459
121	Tungsten + Iron	W + Fe	462
122	Vanadium + Aluminum	V + Al	465
123	Vanadium + Antimony	V + Sb	468
124	Vanadium + Iron	V + Fe	471
125	Vanadium + Tin	V + Sn	474
126	Vanadium + Titanium	V + Ti	477
127	Zinc + Copper	Zn + Cu	480
128	Zinc + Magnesium	Zn + Mg	483

2. NONFERROUS BINARY ALLOYS (continued)

Figure and/or Table No.	Name	Formula	Page No.
129	Zinc + Zirconium	Zn + Zr	486
130	Zirconium + Indium	Zr + In	489
131	Zirconium + Iron	Zr + Fe	492
132	Zirconium + Niobium	Zr + Nb	495
133	Zirconium + Silver	Zr + Ag	498
134	Zirconium + Tin	Zr + Sn	501
135	Zirconium + Titanium	Zr + Ti	504
136	Zirconium + Uranium	Zr + U	507

3. NONFERROUS MULTIPLE ALLOYS

137	Aluminum + Copper + ΣX_i	Al + Cu + ΣX_i	511
138	Aluminum + Zinc + ΣX_i	Al + Zn + ΣX_i	514
139	Chromium + Aluminum + ΣX_i	Cr + Al + ΣX_i	517
140	Chromium + Iron + ΣX_i	Cr + Fe + ΣX_i	520
141	Cobalt + Chromium + ΣX_i	Co + Cr + ΣX_i	523
142	Copper + Chromium + ΣX_i	Cu + Cr + ΣX_i	526
143	Copper + Magnesium + Aluminum, $MgCu_{2-x}Al_x$	Cu + Mg + Al	529
144	Copper + Magnesium + Silicon, $MgCu_{2-x}Si_x$	Cu + Mg + Si	532
145	Magnesium + Aluminum + ΣX_i	Mg + Al + ΣX_i	535
146	Magnesium + Thorium + ΣX_i	Mg + Th + ΣX_i	538
147	Magnesium + Zinc + ΣX_i	Mg + Zn + ΣX_i	541
148	Molybdenum + Titanium + ΣX_i	Mo + Ti + ΣX_i	544
149	Neptunium + Calcium + ΣX_i	Np + Ca + ΣX_i	547
150	Nickel + Chromium + ΣX_i	Ni + Cr + ΣX_i ($9 \leq Cr \leq 11$)	550
151	Nickel + Chromium + ΣX_i	Ni + Cr + ΣX_i ($15 \leq Cr \leq 16$)	553
152	Nickel + Chromium + ΣX_i	Ni + Cr + ΣX_i ($18 \leq Cr \leq 20$)	556
153	Nickel + Chromium + ΣX_i	Ni + Cr + ΣX_i ($Cr > 20$)	559
154	Nickel + Copper + ΣX_i	Ni + Cu + ΣX_i	562
155	Nickel + Iron + ΣX_i	Ni + Fe + ΣX_i	565
156	Nickel + Manganese + ΣX_i	Ni + Mn + ΣX_i	568
157	Nickel + Molybdenum + ΣX_i	Ni + Mo + ΣX_i	571
158	Niobium + Iron + ΣX_i	Nb + Fe + ΣX_i	574
159	Niobium + Molybdenum + ΣX_i	Nb + Mo + ΣX_i	577
160	Niobium + Tantalum + ΣX_i	Nb + Ta + ΣX_i	580
161	Niobium + Titanium + ΣX_i	Nb + Ti + ΣX_i	583
162	Niobium + Tungsten + ΣX_i	Nb + W + ΣX_i	586
163	Plutonium + Cerium + ΣX_i	Pu + Ce + ΣX_i	589
164	Tantalum + Niobium + ΣX_i	Ta + Nb + ΣX_i	592
165	Tantalum + Tungsten + ΣX_i	Ta + W + ΣX_i	595
166	Titanium + Aluminum + ΣX_i	Ti + Al + ΣX_i	598
167	Titanium + Chromium + ΣX_i	Ti + Cr + ΣX_i	601

3. NONFERROUS MULTIPLE ALLOYS (continued)

Figure and/or Table No.	Name	Formula	Page No.
168	Titanium + Iron + Cobalt	Ti + Fe + Co	604
169	Titanium + Vanadium + ΣX_i	Ti + V + ΣX_i	607
170	Zirconium + Iron + ΣX_i	Zr + Fe + ΣX_i	610
171	Zirconium + Hafnium + ΣX_i	Zr + Hf + ΣX_i	613
172	Zirconium + Uranium + ΣX_i	Zr + U + ΣX_i	616

4. FERROUS ALLOYS

A. CARBON STEELS GROUP I

173	Iron + Carbon + ΣX_i	Fe + C + ΣX_i (C< 2.00)	619

B. CARBON STEELS GROUP II

174	Iron + Carbon + ΣX_i	Fe + C + ΣX_i (C< 2.00)	623

C. ALLOY STEELS GROUP I

175	Iron + Aluminum	Fe + Al	626
176	Iron + Antimony	Fe + Sb	629
177	Iron + Chromium	Fe + Cr (8≤Cr< 25)	632
178	Iron + Chromium	Fe + Cr (25≤Cr< 50)	635
179	Iron + Chromium + Manganese	Fe + Cr + Mn	638
180	Iron + Cobalt + ΣX_i	Fe + Co + ΣX_i	641
181	Iron + Copper + ΣX_i	Fe + Cu + ΣX_i	644
182	Iron + Manganese + ΣX_i	Fe + Mn + ΣX_i	647
183	Iron + Manganese + ΣX_i	Fe + Mn + ΣX_i (10<Mn≤50)	650
184	Iron + Manganese + Carbon	Fe + Mn + C	655
185	Iron + Nickel + ΣX_i	Fe + Ni + ΣX_i	660
186	Iron + Nickel + Carbon	Fe + Ni + C	665
187	Iron + Silicon + ΣX_i	Fe + Si + ΣX_i	668
188	Iron + Tin	Fe + Sn	672
189	Iron + Titanium	Fe + Ti	675

D. ALLOY STEELS GROUP II

190	AISI 420, Iron + Chromium + ΣX_i	Fe + Cr + ΣX_i	678
191	AISI 430, Iron + Chromium + ΣX_i	Fe + Cr + ΣX_i	681
192	AISI 446, Iron + Chromium + ΣX_i	Fe + Cr + ΣX_i	684
193	Iron + Chromium + Manganese + ΣX_i	Fe + Cr + Mn + ΣX_i (Cr < 5.0)	687

4. FERROUS ALLOYS (continued)

D. ALLOY STEELS GROUP II (continued)

Figure and/or Table No.	Name		Page No.
194	Iron + Chromium + Manganese + ΣX_i	Fe + Cr + Mn + ΣX_i ($14 \leq Cr \leq 27$)	690
195	AISI 301, Iron + Chromium + Nickel + ΣX_i	Fe + Cr + Ni + ΣX_i	693
196	17-7 PH, Iron + Chromium + Nickel + ΣX_i	Fe + Cr + Ni + ΣX_i	696
197	Iron + Chromium + Nickel + ΣX_i	Fe + Cr + Ni + ΣX_i (17-20 Cr, 8-14 Ni)	699
198	AISI 305, Iron + Chromium + Nickel + ΣX_i	Fe + Cr + Ni + ΣX_i	702
199	AISI 310, Iron + Chromium + Nickel + ΣX_i	Fe + Cr + Ni + ΣX_i	705
200	AISI 316, Iron + Chromium + Nickel + ΣX_i	Fe + Cr + Ni + ΣX_i	708
201	AISI 347, Iron + Chromium + Nickel + ΣX_i	Fe + Cr + Ni + ΣX_i	711
202	Crucible HMN, Iron + Chromium + Nickel + ΣX_i	Fe + Cr + Ni + ΣX_i	714
203	Iron + Chromium + Nickel + ΣX_i	Fe + Cr + Ni + ΣX_i (15-16 Cr, 4-5 Ni)	717
204	EI 257, Iron + Chromium + Nickel + ΣX_i	Fe + Cr + Ni + ΣX_i	720
205	Iron + Manganese + ΣX_i	Fe + Mn + ΣX_i	723
206	Iron + Nickel + ΣX_i	Fe + Ni + ΣX_i	726
207	Iron + Nickel + Chromium + ΣX_i	Fe + Ni + Cr + ΣX_i	729
208	Iron + Silicon + ΣX_i	Fe + Si + ΣX_i	732
209	Iron + Titanium + ΣX_i	Fe + Ti + ΣX_i	735
210	Iron + Tungsten + ΣX_i	Fe + W + ΣX_i	738

VOLUME 5. SPECIFIC HEAT - NONMETALLIC SOLIDS

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9. IODIDES	485
10. PHOSPHIDES	517
11. SELENIDES	527
12. SILICIDES	559
13. SULFIDES	635
14. TELLURIDES	717
15. BROMIDES	759
16. CHLORIDES	785
17. FLUORIDES	915
18. HYDRIDES	1033
19. NITRIDES	1075
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GROUPING OF MATERIALS AND LIST OF FIGURES AND TABLES

1. ELEMENTS

Figure and/or Table No.	Name	Symbol	Page No.
1	Boron	B	1
2A	Carbon (Diamond)	C	4
2B	Carbon (Graphite)	C	9
3	Iodine	I	15
4	Phosphorous	P	18
5	Sulfur	S	21

2. OXIDES

		Formula	
6	Aluminum Oxide	Al_2O_3	25
7	Diantimony Tetraoxide	Sb_2O_4	30
8	Diantimony Pentaoxide	Sb_2O_5	33
9	Arsenic Sesquioxide	As_2O_3	36
10	Diarsenic Pentaoxide	As_2O_5	39
11	Barium Oxide	BaO	42
12	Beryllium Oxide	BeO	45
13	Bismuth Sesquioxide	Bi_2O_3	48
14	Boron Sesquioxide	B_2O_3	51
15	Cadmium Oxide	CdO	54
16	Calcium Oxide	CaO	57
17	Cerium Dioxide	CeO_2	60
18	Cerium Sesquioxide	Ce_2O_3	64
19	Chromium Sesquioxide	Cr_2O_3	67
20	Cobalt Monoxide	CoO	70
21	Tricobalt Tetraoxide	Co_3O_4	73
22	Copper(ous) Oxide	Cu_2O	76
23	Copper(ic) Oxide	CuO	80
24	Dysprosium Oxide	Dy_2O_3	83
25	Erbium Oxide	Er_2O_3	86
26	Europium Oxide	Eu_2O_3	89
27	Gadolinium Oxide	Gd_2O_3	92
28	Gallium Oxide	Ga_2O_3	95
29	Germanium Dioxide	GeO_2	98
30	Hafnium Dioxide	HfO_2	101
31	Holmium Oxide	Ho_2O_3	104
32	Iron(ous) Oxide	$Fe_{0.947}O$	107
33	Iron(ic) Oxide	Fe_2O_3	110
34	Triiron Tetraoxide	Fe_3O_4	114
35	Lanthanum Oxide	La_2O_3	118

2. OXIDES (continued)

Figure and/or Table No.	Name	Formula	Page No.
36	Lead Oxide	PbO	122
37	Lead Dioxide	PbO_2	125
38	Lead Sesquioxide	Pb_2O_3	128
39	Trilead Tetraoxide	Pb_3O_4	131
40	Lithium Oxide	Li_2O	134
41	Lutetium Sesquioxide	Lu_2O_3	137
42	Magnesium Oxide	MgO	140
43	Manganese Monoxide	MnO	145
44	Manganese Dioxide	MnO_2	148
45	Manganese Sesquioxide	Mn_2O_3	151
46	Trimanganese Tetraoxide	Mn_3O_4	154
47	Mercury(ic) Oxide	HgO	157
48	Molybdenum Dioxide	MoO_2	160
49	Molybdenum Trioxide	MoO_3	163
50	Neodymium Oxide	Nd_2O_3	166
51	Neptunium Dioxide	NpO_2	169
52	Nickel Oxide	NiO	172
53	Niobium Monoxide	NbO	175
54	Niobium Dioxide	NbO_2	178
55	Diniobium Pentaoxide	Nb_2O_5	181
56	Potassium Superoxide	KO_2	184
57	Hexapraseodymium Undecaoxide	Pr_6O_{11}	187
58	Plutonium Dioxide	PuO_2	190
59	Samarium Oxide	Sm_2O_3	193
60	Scandium Oxide	Sc_2O_3	196
61	Silver Oxide	Ag_2O	199
62A	Silicon Dioxide (Quartz glass)	SiO_2	202
62B	Silicon Dioxide (Quartz crystal)	SiO_2	207
62C	Silicon Dioxide (Cristobalite)	SiO_2	210
62D	Silicon Dioxide (Tridymite)	SiO_2	213
63	Sodium Oxide	Na_2O	216
64	Sodium Peroxide	Na_2O_2	219
65	Sodium Superoxide	NaO_2	222
66	Strontium Oxide	SrO	225
67	Ditantalum Pentaoxide	Ta_2O_5	228
68	Tellurium Dioxide	TeO_2	231
69	Thorium Dioxide	ThO_2	234
70	Tin Monoxide (Stannous oxide)	SnO	237
71	Tin Dioxide (Stannic oxide)	SnO_2	240
72	Titanium Monoxide	TiO	243
73	Titanium Dioxide	TiO_2	246
74	Titanium Sesquioxide	Ti_2O_3	250
75	Trititanium Pentaoxide	Ti_3O_5	253
76	Tungsten Trioxide	WO_3	256
77	Uranium Dioxide	UO_2	259
78	Uranium Trioxide	UO_3	262

2. OXIDES (continued)

Figure and/or Table No.	Name	Formula	Page No.
79	Triuranium Octaoxide	U_3O_8	265
80	Tetrauranium Nonaoxide	U_4O_9	269
81	Vanadium Monoxide	VO	272
82	Vanadium Sesquioxide	V_2O_3	275
83	Divanadium Tetraoxide	V_2O_4	278
84	Divanadium Pentaoxide	V_2O_5	281
85	Ytterbium Oxide	Yb_2O_3	284
86	Yttrium Oxide	Y_2O_3	287
87	Zinc Oxide	ZnO	290
88	Zirconium Dioxide	ZrO_2	293

3. ANTIMONIDES

89	Aluminum Antimonide	AlSb	297
90	Gallium Antimonide	GaSb	300
91	Indium Antimonide	InSb	303

4. ARSENIDES

92	Gallium Arsenide	GaAs	307
93	Indium Arsenide	InAs	310

5. BERYLLIDES

94	Dihafnium 21-Beryllide	Hf_2Be_{21}	313
95	Molybdenum Dodecaberyllide	$MoBe_{12}$	316
96	Niobium Dodecaberyllide	$NbBe_{12}$	319
97	Tantalum Dodecaberyllide	$TaBe_{12}$	322
98	Ditantalum 17-Beryllide	Ta_2Be_{17}	325
99	Titanium Dodecaberyllide	$TiBe_{12}$	328
100	Zirconium 13-Beryllide	$ZrBe_{13}$	331

6. BORIDES

101	Chromium Monoboride	CrB	335
102	Chromium Diboride	CrB_2	338
103	Hafnium Diboride	HfB_2	341
104	Magnesium Diboride	MgB_2	345
105	Magnesium Tetraboride	MgB_4	348
106	Molybdenum Diboride	MoB_2	352
107	Dimolybdenum Boride	Mo_2B	355

6. BORIDES (continued)

Figure and/or Table No.	Name	Formula	Page No.
108	Molybdenum Boride	MoB	358
109	Niobium Boride (Nonstoichiometric)	NbB_x	361
110	Niobium Diboride	NbB_2	365
111	Tantalum Diboride	TaB_2	368
112	Tantalum Boride	TaB	372
113	Thorium Tetraboride	ThB_4	375
114	Titanium Diboride	TiB_2	378
115	Tungsten Boride	WB	382
116	Ditungsten Boride	W_2B	385
117	Ditungsten Pentaboride	W_2B_5	388
118	Zirconium Diboride	ZrB_2	391

7. CARBIDES

119	Aluminum Carbide + ΣX_i	$Al_4C_3 + \Sigma X_i$	395
120	Diberyllium Carbide + ΣX_i	$Be_2C + \Sigma X_i$	399
121	Tetraboron Carbide	B_4C	402
122	Calcium Dicarbide	CaC_2	405
123	Trichromium Dicarbide	Cr_3C_2	408
124	Pentachromium Dicarbide	Cr_5C_2	411
125	Tetrachromium Carbide	Cr_4C	414
126	Heptachromium Tricarbide	Cr_7C_3	417
127	Hafnium Carbide	HfC	420
128	Triiron Carbide	Fe_3C	424
129	Trimanganese Aluminum Carbide	Mn_3AlC	427
130	Trimanganese Zinc Carbide	Mn_3ZnC	430
131	Trimanganese Carbide	Mn_3C	433
132	Dimolybdenum Carbide	Mo_2C	436
133	Niobium Carbide (Nonstoichiometric)	NbC_x	439
134	Niobium Carbide	NbC	442
135	Plutonium Carbide	PuC	445
136	Silicon Carbide	SiC	448
137	Tantalum Carbide	TaC	451
138	Thorium Carbide (Nonstoichiometric)	ThC_x	454
139	Titanium Carbide	TiC	457
140	Tungsten Carbide	WC	460
141	Uranium Carbide	UC	463
142	Uranium Dicarbide	UC_2	466
143	Uranium Carbide (Nonstoichiometric)	UC_x	469
144	Diuranium Tricarbide	U_2C_3	472
145	Vanadium Carbide	VC	475
146	Zirconium Carbide	ZrC	478

8. GERMANIDES

Figure and/or Table No.	Name	Formula	Page No.
147	Dimagnesium Germanide	Mg_2Ge	481

9. IODIDES

148	Antimony Sulfur Iodide	SbSI	485
149	Arsenic Triiodide	AsI_3	488
150	Cadmium Diiodide	CdI_2	491
151	Cesium Iodide	CsI	494
152	Lead Diiodide	PbI_2	497
153	Potassium Iodide	KI	500
154	Rubidium Iodide	RbI	503
155	Sodium Iodide	NaI	506
156	Titanium Tetraiodide	TiI_4	510
157	Uranium Tetraiodide	UI_4	513

10. PHOSPHIDES

158	Aluminum Phosphide	AlP	517
159	Gallium Phosphide	GaP	520
160	Indium Phosphide	InP	523

11. SELENIDES

161	Iron Diselenide	$FeSe_2$	527
162	Iron Selenide (Nonstoichiometric)	Fe_xSe	530
163	Heptairon Octaselenide	Fe_7Se_8	533
164	Triiron Tetraselenide	Fe_3Se_4	536
165	Manganous Selenide	MnSe	539
166	Mercury Selenide	HgSe	542
167	Nickel Selenide (Nonstoichiometric)	Ni_xSe	545
168	Nickel Diselenide	$NiSe_2$	549
169	Disilver Selenide	Ag_2Se	553
170	Silver Selenide (Nonstoichiometric)	Ag_xSe	556

12. SILICIDES

171	Trichromium Silicide	Cr_3Si	559
172	Pentachromium Trisilicide	Cr_5Si_3	562
173	Chromium Silicide	CrSi	565
174	Chromium Disilicide	$CrSi_2$	568
175	Cobalt Silicide	CoSi	571

12. SILICIDES (continued)

Figure and/or Table No.	Name	Formula	Page No.
176	Germanium Silicide (Nonstoichiometric)	Ge_xSi_y	574
177	Iron Silicide	FeSi	577
178	Pentairon Trisilicide	Fe_5Si_3	580
179	Triiron Silicide	Fe_3Si	583
180	Trimanganese Silicide	Mn_3Si	586
181	Manganese Silicide (Nonstoichiometric)	$MnSi_x$	589
182	Molybdenum Disilicide	$MoSi_2$	592
183	Trimolybdenum Silicide	Mo_3Si	595
184	Tantalum Disilicide	$TaSi_2$	598
185	Titanium Silicide	TiSi	601
186	Titanium Disilicide	$TiSi_2$	604
187	Pentatitanium Trisilicide	Ti_5Si_3	607
188	Tungsten Disilicide	WSi_2	610
189	Triuranium Silicide	U_3Si	613
190	Uranium Trisilicide	USi_3	616
191	Uranium Disilicide	USi_2	619
192	Triuranium Disilicide + Triuranium Monosilicide	U_3Si_2 + U_3Si	622
193	Trivanadium Silicide	V_3Si	625
194	Vanadium Disilicide	VSi_2	628
195	Pentavanadium Trisilicide	V_5Si_3	631

13. SULFIDES

196	Diantimony Trisulfide	Sb_2S_3	635
197	Arsenic Sulfide	AsS	638
198	Diarsenic Trisulfide	As_2S_3	641
199	Barium Sulfide	BaS	644
200	Dibismuth Trisulfide	Bi_2S_3	647
201	Cadmium Sulfide	CdS	650
202	Calcium Sulfide	CaS	653
203	Cerium Sulfide	CeS	656
204	Dicerium Trisulfide	Ce_2S_3	659
205	Copper Sulfide	CuS	662
206	Dicopper Sulfide	Cu_2S	665
207	Diindium Sulfide (Nonstoichiometric)	In_2S_x	668
208	Iron Sulfide (Nonstoichiometric)	Fe_xS	671
209	Iron Sulfide	FeS	674
210	Iron Disulfide	FeS_2	677
211	Lead Sulfide	PbS	681
212	Manganese Sulfide	MnS	684
213	Mercury Sulfide	HgS	687
214	Molybdenum Disulfide	MoS_2	690
215	Nickel Sulfide	NiS	693
216	Trinickel Disulfide	Ni_3S_2	696
217	Platinum Sulfide	PtS	699
218	Platinum Disulfide	PtS_2	702

13. SULFIDES (continued)

Figure and/or Table No.	Name	Formula	Page No.
219	Silver Sulfide (Nonstoichiometric)	Ag_xS	705
220	Strontium Sulfide	SrS	708
221	Strontium Disulfide	SrS_2	711
222	Zinc Sulfide	ZnS	714

14. TELLURIDES

223	Dibismuth Tritelluride	Bi_2Te_3	717
224	Cadmium Telluride	$CdTe$	720
225	Digallium Tritelluride	Ga_2Te_3	723
226	Iron Telluride (Nonstoichiometric)	Fe_xTe	726
227	Iron Ditelluride	$FeTe_2$	729
228	Manganous Telluride	$MnTe$	732
229	Nickel Telluride (Nonstoichiometric)	$NiTe_x$	735
230	Nickel Ditelluride	$NiTe_2$	738
231	Palladium Telluride	$PdTe$	741
232	Palladium Ditelluride	$PdTe_2$	744
233	Platinum Telluride	$PtTe$	747
234	Platinum Ditelluride	$PtTe_2$	750
235	Disilver Telluride	Ag_2Te	753
236	Silver Telluride (Nonstoichiometric)	Ag_xTe	756

15. BROMIDES

237	Cadmium Dibromide	$CdBr_2$	759
238	Copper Bromide	$CuBr$	762
239	Potassium Bromide	KBr	765
240	Rubidium Bromide	$RbBr$	769
241	Sodium Bromide	$NaBr$	772
242	Strontium Bromide	$SrBr$	775
243	Titanium Tribromide	$TiBr_3$	778
244	Titanium Tetrabromide	$TiBr_4$	781

16. CHLORIDES

245	Barium Dichloride	$BaCl_2$	785
246	Barium Dichloride Dihydrate	$BaCl_2 \cdot 2H_2O$	788
247	Cadmium Dichloride	$CdCl_2$	791
248	Calcium Dichloride	$CaCl_2$	794
249	Cesium Chloride	$CsCl$	797
250	Chromium Dichloride	$CrCl_2$	800

16. CHLORIDES (continued)

Figure and/or Table No.	Name	Formula	Page No.
251	Chromium Trichloride	$CrCl_3$	803
252	Cobalt Dichloride	$CoCl_2$	806
253	Cobalt Dichloride Hexahydrate	$CoCl_2 \cdot 6H_2O$	809
254	Copper Dichloride	$CuCl_2$	812
255	Copper Dichloride Dihydrate	$CuCl_2 \cdot 2H_2O$	815
256	Dysprosium Trichloride Hexahydrate	$DyCl_3 \cdot 6H_2O$	818
257	Erbium Trichloride Hexahydrate	$ErCl_3 \cdot 6H_2O$	822
258	Gadolinium Trichloride Hexahydrate	$GdCl_3 \cdot 6H_2O$	826
259	Holmium Trichloride Hexahydrate	$HoCl_3 \cdot 6H_2O$	829
260	Iron Dichloride	$FeCl_2$	832
261	Lithium Chloride	$LiCl$	835
262	Magnesium Dichloride	$MgCl_2$	838
263	Magnesium Dichloride Monohydrate	$MgCl_2 \cdot H_2O$	841
264	Magnesium Dichloride Dihydrate	$MgCl_2 \cdot 2H_2O$	844
265	Magnesium Dichloride Tetrahydrate	$MgCl_2 \cdot 4H_2O$	847
266	Magnesium Dichloride Hexahydrate	$MgCl_2 \cdot 6H_2O$	850
267	Manganese Dichloride	$MnCl_2$	853
268	Manganous Dichloride Tetrahydrate	$MnCl_2 \cdot 4H_2O$	856
269	Neodymium Trichloride Hexahydrate	$NdCl_3 \cdot 6H_2O$	859
270	Nickel Dichloride	$NiCl_2$	863
271	Nickel Dichloride Hexahydrate	$NiCl_2 \cdot 6H_2O$	866
272	Phosphorus Trichloride	PCl_3	869
273	Potassium Chloride	KCl	872
274	Rhenium Trichloride	$ReCl_3$	878
275	Silicon Tetrachloride	$SiCl_4$	881
276	Silver Chloride	$AgCl$	884
277	Sodium Chloride	$NaCl$	887
278	Strontium Dichloride	$SrCl_2$	890
279	Titanium Trichloride	$TiCl_3$	893
280	Uranium Trichloride	UCl_3	896
281	Uranium Tetrachloride	UCl_4	899
282	Vanadium Dichloride	VCl_2	902
283	Vanadium Trichloride	VCl_3	905
284	Zinc Dichloride	$ZnCl_2$	908
285	Zirconium Tetrachloride	$ZrCl_4$	911

17. FLUORIDES

286	Aluminum Trifluoride	AlF_3	915
287	Barium Difluoride	BaF_2	918
288	Beryllium Difluoride	BeF_2	921
289	Calcium Difluoride	CaF_2	924
290	Cerium Trifluoride	CeF_3	927
291	Cesium Monohydrogen Difluoride	$CsHF_2$	931
292	Cobalt Difluoride	CoF_2	934
293	Hafnium Tetrafluoride	HfF_4	937
294	Iron Difluoride	FeF_2	940
295	Lithium Fluoride	LiF	943

17. FLUORIDES (continued)

Figure and/or Table No.	Name	Formula	Page No.
296	Trilithium Aluminum Hexafluoride	Li_3AlF_6	947
297	Dilithium Beryllium Tetrafluoride	Li_2BeF_4	950
298	Lithium Monohydrogen Difluoride	$LiHF_2$	953
299	Magnesium Difluoride	MgF_2	956
300	Manganese Difluoride	MnF_2	959
301	Molybdenum Hexafluoride	MoF_6	962
302	Nickel Fluosilicate Hexahydrate, A	$NiSiF_6 \cdot 6H_2O$	966
303	Nickel Fluosilicate Hexahydrate, B	$NiSiF_6 \cdot 6H_2O$	970
304	Nickel Difluoride	NiF_2	973
305	Niobium Pentafluoride	NbF_5	976
306	Potassium Fluoride	KF	979
307	Potassium Hydrogen Difluoride	KHF_2	982
308	Rubidium Fluoride	RbF	985
309	Rubidium Monohydrogen Difluoride	$RbHF_2$	988
310	Silicon Tetrafluoride	SiF_4	991
311	Sodium Fluoride	NaF	994
312	Trisodium Aluminum Hexafluoride	Na_3AlF_6	997
313	Sodium Monohydrogen Difluoride	$NaHF_2$	1000
314	Strontium Difluoride	SrF_2	1003
315	Thallium Monohydrogen Difluoride	$TlHF_2$	1006
316	Thorium Tetrafluoride	ThF_4	1009
317	Titanium Tetrafluoride	TiF_4	1012
318	Uranium Tetrafluoride	UF_4	1015
319	Uranium Hexafluoride	UF_6	1018
320	Vanadium Trifluoride	VF_3	1021
321	Xenon Tetrafluoride	XeF_4	1024
322	Zinc Difluoride	ZnF_2	1027
323	Zirconium Tetrafluoride	ZrF_4	1030

18. HYDRIDES

324	Germanium Tetrahydride	GeH_4	1033
325	Lithium Hydride	LiH	1036
326	Ditantalum Hydride	Ta_2H	1040
327	Titanium Hydride (Nonstoichiometric)	TiH_x	1044
328	Titanium Dihydride	TiH_2	1047
329	Uranium Trihydride	UH_3	1050
330	Vanadium Hydride (Nonstoichiometric)	VH_x	1053
331	Yttrium Dihydride	YH_2	1056
332	Yttrium Trihydride	YH_3	1059
333	Yttrium Dideutride	YD_2	1062
334	Yttrium Trideutride	YD_3	1066
335	Zirconium Hydride (Nonstoichiometric)	ZrH_x	1069
336	Zirconium Dihydride	ZrH_2	1072

19. NITRIDES

Figure and/or Table No.	Name	Formula	Page No.
337	Aluminum Nitride	AlN	1075
338	Boron Nitride	BN	1078
339	Hafnium Nitride	HfN	1081
340	Trimagnesium Dinitride	Mg_3N_2	1084
341	Silicon Nitride	SiN	1087
342	Tantalum Nitride	TaN	1090
343	Titanium Nitride	TiN	1093
344	Uranium Nitride	UN	1096
345	Uranium Nitride (Nonstoichiometric)	UN_x	1099
346	Vanadium Nitride	VN	1103
347	Zirconium Nitride	ZrN	1106

20. CARBONATES

348	Barium Carbonate	$BaCO_3$	1109
349	Calcium Carbonate	$CaCO_3$	1112
350	Calcium Magnesium Dicarbonate	$CaMg(CO_3)_2$	1115
351	Dilithium Carbonate	Li_2CO_3	1118
352	Manganese Carbonate	$MnCO_3$	1121
353	Dipotassium Carbonate	K_2CO_3	1124
354	Disilver Carbonate	Ag_2CO_3	1127
355	Disodium Carbonate	Na_2CO_3	1130
356	Sodium Bicarbonate	$NaHCO_3$	1133
357	Strontium Carbonate	$SrCO_3$	1136

21. NITRATES and NITRITES

358	Barium Dinitrate	$Ba(NO_3)_2$	1139
359	Gadolinium Trinitrate Hexahydrate	$Gd(NO_3)_3 \cdot 6H_2O$	1142
360	Potassium Nitrate	KNO_3	1145
361	Silver Nitrite	$AgNO_2$	1148
362	Sodium Nitrate	$NaNO_3$	1151
363	Strontium Nitrate	$SrNO_3$	1154
364	Thallium Nitrate	$TlNO_3$	1157

22. SULFATES

365	Dialuminum Trisulfate	$Al_2(SO_4)_3$	1161
366	Dialuminum Trisulfate Hexahydrate	$Al_2(SO_4)_3 \cdot 6H_2O$	1164
367	Diammonium Sulfate	$(NH_4)_2SO_4$	1167
368	Ammonium Aluminum Disulfate	$NH_4Al(SO_4)_2$	1170
369	Ammonium Aluminum Disulfate Dodecahydrate	$NH_4Al(SO_4)_2 \cdot 12H_2O$	1173

22. SULFATES (continued)

Figure and/or Table No.	Name	Formula	Page No.
370	Barium Sulfate	$BaSO_4$	1176
371	Beryllium Sulfate	$BeSO_4$	1179
372	Calcium Sulfate	$CaSO_4$	1182
373	Calcium Sulfate Hemihydrate	$CaSO_4 \cdot \frac{1}{2}H_2O$	1185
374	Calcium Sulfate Dihydrate	$CaSO_4 \cdot 2H_2O$	1188
375	Cesium Aluminum Disulfate Dodecahydrate	$CsAl(SO_4)_2 \cdot 12H_2O$	1191
376	Cobalt Sulfate Heptahydrate	$CoSO_4 \cdot 7H_2O$	1194
377	Dieuroplum Trisulfate Octahydrate	$Eu_2(SO_4)_3 \cdot 8H_2O$	1197
378	Iron Sulfate Heptahydrate	$FeSO_4 \cdot 7H_2O$	1200
379	Dimercury Sulfate	Hg_2SO_4	1203
380	Nickel Sulfate Hexahydrate	$NiSO_4 \cdot 6H_2O$	1206
381	Dipotassium Sulfate	K_2SO_4	1209
382	Potassium Aluminum Disulfate	$KAl(SO_4)_2$	1212
383	Potassium Aluminum Disulfate Dodecahydrate	$KAl(SO_4)_2 \cdot 12H_2O$	1215
384	Disodium Sulfate	Na_2SO_4	1218
385	Disodium Sulfate Decahydrate	$Na_2SO_4 \cdot 10H_2O$	1221
386	Zinc Sulfate Heptahydrate	$ZnSO_4 \cdot 7H_2O$	1224

23. GLASSES and CERMETS

387	Aluminosilicate Glass	$SiO_2 + Al_2O_3 + \Sigma X_i$	1227
388	Borosilicate Glass	$SiO_2 + B_2O_3 + \Sigma X_i$	1230
389	High Silica Glass	$SiO_2 + \Sigma X_i$	1234
390	Pyroceram		1237
391	Soda Lime Glass	$SiO_2 + Na_2O + \Sigma X_i$	1240
392	Beryllium + Beryllium Oxide, Cermet	Be + BeO	1243
393	Beryllium Oxide + Beryllium, Cermet	BeO + Be	1246
394	Beryllium Oxide + Beryllium + Molybdenum, Cermet	BeO + Be + Mo	1249
395	Beryllium Oxide + Molybdenum, Cermet	BeO + Mo	1252
396	Beryllium Oxide + Molybdenum Dodecaberyllide, Cermet	$BeO + MoBe_{12}$	1255
397	Beryllium Oxide + Niobium Dodecaberyllide, Cermet	$BeO + NbBe_{12}$	1258
398	Beryllium Oxide + Tantalum Dodecaberyllide, Cermet	$BeO + TaBe_{12}$	1261
399	Beryllium Oxide + Titanium Dodecaberyllide, Cermet	$BeO + TiBe_{12}$	1264
400	Beryllium Oxide + Zirconium 13-Beryllide, Cermet	$BeO + ZrBe_{13}$	1267
401	Boron Nitride + Diboron Trioxide + ΣX_i, Cermet	$BN + B_2O_3 + \Sigma X_i$	1270
402	Boron Nitride + Carbon, Cermet	BN + C	1273
403	Carbon + Silicon Carbide, Cermet	C + SiC	1276
404	Silicon Carbide + Carbon + ΣX_i, Cermet	$SiC + C + \Sigma X_i$	1279
405	Tungsten Carbide + Cobalt, Cermet	WC + Co	1282
406	Zirconium Dioxide + Titanium, Cermet	$ZrO_2 + Ti$	1285

Figure and/or Table No.	Name	Formula	Page No.
407	Dialuminum Silicon Pentaoxide	Al_2SiO_5	1289
408	Hexaaluminum Disilicon 13-Oxide	$Al_6Si_2O_{13}$	1292
409	Dialuminum Disilicon Heptaoxide Dihydrate	$Al_2Si_2O_7 \cdot 2H_2O$	1295
410	Dialuminum Titanium Pentaoxide	Al_2TiO_5	1298
411	Barium Silicon Trioxide	$BaSiO_3$	1301
412	Dibarium Silicon Tetraoxide	Ba_2SiO_4	1304
413	Barium Disilicon Pentaoxide	$BaSi_2O_5$	1307
414	Dibarium Trisilicon Octaoxide	$Ba_2Si_3O_8$	1310
415	Barium Titanium Trioxide	$BaTiO_3$	1313
416	Dibarium Titanium Tetraoxide	Ba_2TiO_4	1316
417	Barium Uranium Tetraoxide	$BaUO_4$	1319
418	Barium Zirconium Trioxide	$BaZrO_3$	1322
419	Beryllium Dialuminum Tetraoxide	$BeAl_2O_4$	1325
420	Diberyllium Silicon Tetraoxide	Be_2SiO_4	1329
421	Calcium Dialuminum Tetraoxide	$CaAl_2O_4$	1332
422	Calcium Tetraaluminum Heptaoxide	$CaAl_4O_7$	1335
423	Tricalcium Dialuminum Hexaoxide	$Ca_3Al_2O_6$	1338
424	Dodecacalcium 14-Aluminum 33-Oxide	$Ca_{12}Al_{14}O_{33}$	1341
425	Calcium Diboron Tetraoxide	CaB_2O_4	1344
426	Calcium Tetraboron Heptaoxide	CaB_4O_7	1347
427	Dicalcium Diboron Pentaoxide	$Ca_2B_2O_5$	1350
428	Tricalcium Diboron Hexaoxide	$Ca_3B_2O_6$	1353
429	Calcium Diiron Tetraoxide	$CaFe_2O_4$	1356
430	Dicalcium Diiron Pentaoxide	$Ca_2Fe_2O_5$	1359
431	Calcium Molybdenum Tetraoxide	$CaMoO_4$	1362
432	Calcium Silicon Trioxide	$CaSiO_3$	1365
433	Dicalcium Silicon Tetraoxide	Ca_2SiO_4	1368
434	Tricalcium Silicon Pentaoxide	Ca_3SiO_5	1371
435	Tricalcium Disilicon Heptaoxide	$Ca_3Si_2O_7$	1374
436	Calcium Titanium Trioxide	$CaTiO_3$	1377
437	Tricalcium Dititanium Heptaoxide	$Ca_3Ti_2O_7$	1380
438	Calcium Tungsten Tetraoxide	$CaWO_4$	1383
439	Calcium Uranium Tetraoxide	$CaUO_4$	1386
440	Calcium Divanadium Hexaoxide	CaV_2O_6	1389
441	Dicalcium Divanadium Heptaoxide	$Ca_2V_2O_7$	1392
442	Tricalcium Divanadium Octaoxide	$Ca_3V_2O_8$	1395
443	Calcium Zirconium Trioxide	$CaZrO_3$	1398
444	Dicalcium Dialuminum Silicon Heptaoxide	$Ca_2Al_2SiO_7$	1401
445	Calcium Dialuminum Disilicon Octaoxide	$CaAl_2Si_2O_8$	1404
446	Calcium Dialuminum Disilicon Octaoxide Dihydrate	$CaAl_2Si_2O_8 \cdot 2H_2O$	1407
447	Dicalcium Tetraaluminum Octasilicon 24-Oxide Heptahydrate	$Ca_2Al_4Si_8O_{24} \cdot 7H_2O$	1410
448	Calcium Magnesium Disilicon Hexaoxide	$CaMgSi_2O_6$	1413
449	Dicalcium Magnesium Disilicon Heptaoxide	$Ca_2MgSi_2O_7$	1416
450	Tricalcium Magnesium Disilicon Octaoxide	$Ca_3MgSi_2O_8$	1419
451	Dicalcium Pentamagnesium Octasilicon 23-Oxide Monohydrate	$Ca_2Mg_5Si_8O_{23} \cdot H_2O$	1422

Figure and/or Table No.	Name	Formula	Page No.
452	Cobalt Diiron Tetraoxide	$CoFe_2O_4$	1425
453	Cobalt Iron Tetraoxide (Nonstoichiometric)	$Co_xFe_yO_4$	1428
454	Cobalt Tungsten Tetraoxide	$CoWO_4$	1431
455	Copper Iron Tetraoxide (Nonstoichiometric)	$Cu_xFe_yO_4$	1434
456	Copper Diiron Tetraoxide	$CuFe_2O_4$	1437
457	Trierbium Pentagallium Dodecaoxide (Garnet)	$Er_3Ga_5O_{12}$	1440
458	Iron Dialuminum Tetraoxide	$FeAl_2O_4$	1443
459	Iron Dichromium Tetraoxide	$FeCr_2O_4$	1446
460	Iron Dicobalt Tetraoxide	$FeCo_2O_4$	1449
461	Diiron Silicon Tetraoxide	Fe_2SiO_4	1452
462	Iron Titanium Trioxide	$FeTiO_3$	1455
463	Lead Molybdenum Tetraoxide	$PbMoO_4$	1458
464	Lead Tungsten Tetraoxide	$PbWO_4$	1461
465	Lithium Aluminum Dioxide	$LiAlO_2$	1464
466	Lithium Iron Dioxide	$LiFeO_2$	1467
467	Lithium Iron Tetraoxide (Nonstoichiometric)	$Li_xFe_yO_4$	1470
468	Dilithium Titanium Trioxide	Li_2TiO_3	1473
469	Lithium Zinc Iron Tetraoxide (Nonstoichiometric)	$Li_xZn_yFe_zO_4$	1476
470	Magnesium Dialuminum Tetraoxide	$MgAl_2O_4$	1479
471	Magnesium Dichromium Tetraoxide	$MgCr_2O_4$	1482
472	Magnesium Diiron Tetraoxide	$MgFe_2O_4$	1485
473	Magnesium Iron Tetraoxide (Nonstoichiometric)	$Mg_xFe_yO_4$	1488
474	Magnesium Molybdenum Tetraoxide	$MgMoO_4$	1491
475	Magnesium Silicon Trioxide	$MgSiO_3$	1494
476	Dimagnesium Silicon Tetraoxide	Mg_2SiO_4	1497
477	Trimagnesium Tetrasilicon Undecaoxide Monohydrate	$Mg_3Si_4O_{11} \cdot H_2O$	1500
478	Dimagnesium Tetraaluminum Pentasilicon 18-Oxide	$Mg_2Al_4Si_5O_{18}$	1503
479	Magnesium Titanium Trioxide	$MgTiO_3$	1506
480	Magnesium Dititanium Pentaoxide	$MgTi_2O_5$	1509
481	Dimagnesium Titanium Tetraoxide	Mg_2TiO_4	1512
482	Magnesium Tungsten Tetraoxide	$MgWO_4$	1515
483	Magnesium Divanadium Hexaoxide	MgV_2O_6	1518
484	Dimagnesium Divanadium Heptaoxide	$Mg_2V_2O_7$	1521
485	Manganese Silicon Trioxide	$MnSiO_3$	1524
486	Trineodymium Pentagallium Dodecaoxide (Garnet)	$Nd_3Ga_5O_{12}$	1527
487	Nickel Diiron Tetraoxide	$NiFe_2O_4$	1530
488	Nickel Iron Tetraoxide (Nonstoichiometric)	$Ni_xFe_yO_4$	1533
489	Nickel Zinc Diiron Tetraoxide (Nonstoichiometric)	$Ni_xZn_yFe_2O_4$	1536
490	Potassium Trialuminum Trisilicon Undecaoxide	$KAl_3Si_3O_{11}$	1540
491	Potassium Trialuminum Trisilicon Undecaoxide Monohydrate	$KAl_3Si_3O_{11} \cdot H_2O$	1543
492	Silicon Dioxide + Dialuminum Trioxide + ΣX_i	$SiO_2 + Al_2O_3 + \Sigma X_i$	1546
493	Sodium Aluminum Dioxide	$NaAlO_2$	1649
494	Sodium Boron Dioxide	$NaBO_2$	1652
495	Disodium Tetraboron Heptaoxide	$Na_2B_4O_7$	1656

Figure and/or Table No.	Name	Formula	Page No.
496	Sodium Iron Dioxide	$NaFeO_2$	1560
497	Disodium Molybdenum Tetraoxide	Na_2MoO_4	1563
498	Disodium Dimolybdenum Heptaoxide	$Na_2Mo_2O_7$	1566
499	Disodium Silicon Trioxide	Na_2SiO_3	1569
500	Disodium Disilicon Pentaoxide	$Na_2Si_2O_5$	1572
501	Disodium Tellurium Tetraoxide	Na_2TeO_4	1575
502	Disodium Titanium Trioxide	Na_2TiO_3	1578
503	Disodium Dititanium Pentaoxide	$Na_2Ti_2O_5$	1581
504	Disodium Trititanium Heptaoxide	$Na_2Ti_3O_7$	1584
505	Disodium Tungsten Tetraoxide	Na_2WO_4	1587
506	Disodium Ditungsten Heptaoxide	$Na_2W_2O_7$	1590
507	Sodium Vanadium Trioxide	$NaVO_3$	1593
508	Trisodium Vanadium Tetraoxide	Na_3VO_4	1596
509	Tetrasodium Divanadium Heptaoxide	$Na_4V_2O_7$	1599
510	Sodium Aluminum Trisilicon Octaoxide	$NaAlSi_3O_8$	1602
511	Strontium Silicon Trioxide	$SrSiO_3$	1605
512	Distrontium Silicon Tetraoxide	Sr_2SiO_4	1608
513	Strontium Titanium Trioxide	$SrTiO_3$	1611
514	Distrontium Titanium Tetraoxide	Sr_2TiO_4	1614
515	Strontium Zirconium Trioxide	$SrZrO_3$	1617
516	Triytterbium Pentagallium Dodecaoxide(Garnet)	$Yb_3Ga_5O_{12}$	1620
517	Triyttrium Pentagallium Dodecaoxide(Garnet)	$Y_3Ga_5O_{12}$	1623
518	Zinc Diiron Tetraoxide	$ZnFe_2O_4$	1626
519	Dizinc Silicon Tetraoxide	Zn_2SiO_4	1629
520	Dizinc Titanium Tetraoxide	Zn_2TiO_4	1632
521	Zirconium Silicon Tetraoxide	$ZrSiO_4$	1635

VOLUME 6. SPECIFIC HEAT - NONMETALLIC LIQUIDS AND GASES

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GROUPING OF MATERIALS AND LIST OF FIGURES AND TABLES

1. ELEMENTS

Figure and/or Table No.	Name	Symbol	Physical State*	Page No.
1	Argon	A	L, G	1
2	Bromine	Br_2	L, G	7
3	Chlorine	Cl_2	L, G	11
4	Deuterium	D_2	L, G	15
5	Fluorine	F_2	L, G	19
6	Helium	He	-, G	23
7	Hydrogen	H_2	L, G	26
8	Krypton	Kr	L, G	34
9	Neon	Ne	-, G	37
10	Nitrogen	N_2	L, G	39
11	Oxygen	O_2	L, G	48
12	Xenon	Xe	L, G	57

2. INORGANIC COMPOUNDS

13	Ammonia	NH_3	L, G	61
14	Boron Trifluoride	BF_3	L, G	67
15	Hydrogen Chloride	HCl	L, G	72
16	Hydrogen Iodide	HI	-, G	76
17	Hydrogen Sulfide	H_2S	L, G	78
18	Nitric Oxide	NO	L, G	83
19	Nitrogen Peroxide	NO_2	L, -	90
20	Nitrous Oxide	N_2O	L, G	92
21	Sulfur Dioxide	SO_2	L, G	97
22	Water	H_2O	L, G	102

3. ORGANIC COMPOUNDS

23	Acetone	$(CH_3)_2CO$	L, G	113
24	Acetylene	CHCH	-, G	117
25	Benzene	C_6H_6	L, G	121
26	i-Butane	i-C_4H_{10}	L, G	129
27	n-Butane	n-C_4H_{10}	L, G	136
28	Carbon Dioxide	CO_2	L, G	143
29	Carbon Monoxide	CO	L, G	152
30	Carbon Tetrachloride	CCl_4	L, G	159

*L = liquid, G = gas.

3. ORGANIC COMPOUNDS (continued)

Figure and/or Table No.	Name	Formula	Physical State*	Page No.
31	Chloroform	$CHCl_3$	L, G	166
32	n-Decane	$C_{10}H_{22}$	L, G	170
33	Ethane	C_2H_6	L, G	174
34	Ethyl Alcohol	C_2H_5OH	L, G	180
35	Ethylene	CH_2CH_2	L, G	185
36	Ethylene Glycol	CH_2OHCH_2OH	L, -	192
37	Ethyl Ether	$(C_2H_5)_2O$	L, G	194
38	Freon 11	Cl_3CF	L, G	200
39	Freon 12	Cl_2CF_2	L, G	204
40	Freon 13	$ClCF_3$	-, G	210
41	Freon 21	Cl_2CHF	L, G	212
42	Freon 22	$ClCHF_2$	L, G	218
43	Freon 113	CCl_2FCClF_2	L, G	224
44	Freon 114	$CClF_2CClF_2$	-, G	228
45	Glycerol	$CH_2OHCHOHCH_2OH$	L, -	230
46	n-Heptane	C_7H_{16}	L, G	232
47	n-Hexane	C_6H_{14}	L, G	238
48	Methane	CH_4	L, G	244
49	Methyl Alcohol	CH_3OH	L, G	252
50	Methyl Chloride	CH_3Cl	L, G	257
51	n-Nonane	C_9H_{20}	L, G	261
52	n-Octane	C_8H_{18}	L, G	266
53	n-Pentane	C_5H_{12}	L, G	272
54	Propane	C_3H_8	L, G	279
55	Toluene	$C_6H_5CH_3$	L, G	285

4. MIXTURES

56	Air		-, G	293

*L = liquid, G = gas.

VOLUME 7. THERMAL RADIATIVE PROPERTIES - METALLIC ELEMENTS AND ALLOYS

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MATERIAL INDEX A1

GROUPING OF MATERIALS AND LIST OF FIGURES AND TABLES

1. ELEMENTS

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1A	Aluminum - Hemispherical Total Emittance	2
1	Aluminum - Hemispherical Total Emittance	3
2	Aluminum - Normal Total Emittance	8
3	Aluminum - Normal Spectral Emittance	12
4	Aluminum - Angular Spectral Emittance	15
5*	Aluminum - Angular Integrated Reflectance	18
6	Aluminum - Hemispherical Spectral Reflectance	20
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7	Aluminum - Normal Spectral Reflectance	25
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9*	Aluminum - Angular Spectral Reflectance	38
10*	Aluminum - Normal Solar Reflectance	40
11*	Aluminum - Hemispherical Integrated Absorptance	42
12*	Aluminum - Normal Integrated Absorptance	45
13	Aluminum - Normal Spectral Absorptance	47
14*	Aluminum - Angular Spectral Absorptance	50
15	Aluminum - Normal Solar Absorptance	52
16*	Aluminum - Angular Solar Absorptance	55
17	Aluminum - Normal Spectral Transmittance	57
18	Aluminum - Angular Spectral Transmittance	60
19	Antimony - Angular Spectral Reflectance	63
20*	Antimony - Normal Spectral Transmittance	66
21	Barium - Angular Spectral Reflectance	68
22	Beryllium - Normal Total Emittance	71
23*	Beryllium - Normal Spectral Emittance	74
24*	Beryllium - Normal Spectral Emittance	76
25	Beryllium - Normal Spectral Reflectance	78
26	Beryllium - Normal Spectral Transmittance	82
27	Bismuth - Normal Spectral Transmittance	85
28	Bismuth - Angular Spectral Transmittance	88
29*	Cadmium - Hemispherical Total Emittance	91
30	Cadmium - Angular Spectral Reflectance	93
31*	Cadmium - Hemispherical Integrated Absorptance	96
32	Cadmium - Angular Spectral Absorptance	98
33*	Chromium - Hemispherical Total Emittance	101
34	Chromium - Normal Total Emittance	103
35*	Chromium - Normal Spectral Emittance	106
36*	Chromium - Normal Spectral Emittance	108

Note: Figure number with "A" indicates analyzed data graph.
*No figure

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38*	Chromium - Angular Spectral Reflectance	113
39	Chromium - Normal Spectral Absorptance	115
40*	Chromium - Normal Solar Absorptance	118
41	Chromium - Normal Spectral Transmittance	120
42	Cobalt - Normal Total Emittance	123
43A	Cobalt - Normal Spectral Emittance	126
43	Cobalt - Normal Spectral Emittance	127
44	Cobalt - Angular Spectral Reflectance	132
45A	Copper - Hemispherical Total Emittance	136
45	Copper - Hemispherical Total Emittance	137
46A	Copper - Normal Total Emittance	142
46	Copper - Normal Total Emittance	143
47	Copper - Normal Spectral Emittance	149
48A	Copper - Normal Spectral Emittance	152
48	Copper - Normal Spectral Emittance	153
49A	Copper - Normal Spectral Reflectance	158
49	Copper - Normal Spectral Reflectance	159
50	Copper - Angular Spectral Reflectance	165
51	Copper - Angular Spectral Reflectance	169
52	Copper - Normal Solar Reflectance	172
53*	Copper - Hemispherical Integrated Absorptance	177
54*	Copper - Normal Integrated Absorptance	179
55*	Copper - Normal Spectral Absorptance	181
56A	Copper - Normal Spectral Absorptance	184
56	Copper - Normal Spectral Absorptance	185
57	Copper - Angular Spectral Absorptance	188
58*	Copper - Hemispherical Solar Absorptance	191
59	Copper - Normal Solar Absorptance	193
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60	Copper - Normal Spectral Transmittance	199
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62	Gadolinium - Normal Spectral Reflectance	204
63	Gadolinium - Normal Spectral Transmittance	207
64	Gallium - Normal Spectral Reflectance	210
65	Gallium - Normal Spectral Absorptance	213
66	Gallium - Normal Spectral Transmittance	216
67	Germanium - Normal Total Emittance	219
68*	Germanium - Normal Spectral Emittance	222
69A	Germanium - Normal Spectral Emittance	224
69	Germanium - Normal Spectral Emittance	225
70A	Germanium - Normal Spectral Reflectance	230
70	Germanium - Normal Spectral Reflectance	231
71A	Germanium - Normal Spectral Transmittance	236

Note: Figure number with "A" indicates analyzed data graph.
*No figure

1. ELEMENTS (continued)

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72	Germanium - Angular Spectral Transmittance	240
73A	Gold - Hemispherical Total Emittance	244
73	Gold - Hemispherical Total Emittance	245
74*	Gold - Normal Total Emittance	248
75A	Gold - Normal Spectral Emittance	250
75	Gold - Normal Spectral Emittance	251
76	Gold - Normal Spectral Emittance	254
77A	Gold - Normal Spectral Reflectance	258
77	Gold - Normal Spectral Reflectance	259
78	Gold - Angular Spectral Reflectance	264
79*	Gold - Normal Solar Reflectance	267
80*	Gold - Hemispherical Integrated Absorptance	269
81*	Gold - Normal Spectral Absorptance	271
82*	Gold - Normal Spectral Absorptance	273
83*	Gold - Angular Spectral Absorptance	275
84	Gold - Normal Solar Absorptance	277
85*	Hafnium - Hemispherical Total Emittance	280
86*	Hafnium - Normal Spectral Emittance	282
87*	Hafnium - Normal Spectral Emittance	284
88	Indium - Angular Spectral Absorptance	286
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93	Iridium - Angular Spectral Reflectance	299
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99	Iron - Normal Spectral Reflectance	321
100	Iron - Angular Spectral Reflectance	324
101*	Iron - Normal Spectral Absorptance	327
102	Iron - Normal Spectral Absorptance	329
103	Iron - Normal Solar Absorptance	332
104*	Lead - Hemispherical Total Emittance	335
105*	Lead - Normal Total Emittance	337
106*	Lead - Hemispherical Integrated Absorptance	339
107*	Lead - Normal Integrated Absorptance	341
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Note: Figure number with "A" indicates analyzed data graph.
*No figure

1. ELEMENTS (continued)

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111	Lutetium - Normal Spectral Transmittance	350
112	Magnesium - Hemispherical Total Emittance	353
113*	Magnesium - Normal Spectral Reflectance	356
114*	Magnesium - Angular Spectral Reflectance	358
115	Magnesium - Normal Solar Reflectance	360
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123	Molybdenum - Normal Spectral Emittance	387
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124	Molybdenum - Normal Spectral Emittance	393
125	Molybdenum - Normal Spectral Reflectance	398
126*	Molybdenum - Angular Spectral Reflectance	402
127	Molybdenum - Normal Spectral Absorptance	404
128	Molybdenum - Angular Spectral Absorptance	407
129	Molybdenum - Normal Solar Absorptance	410
130	Nickel - Hemispherical Total Emittance	413
131A	Nickel - Normal Total Emittance	416
131	Nickel - Normal Total Emittance	417
132A	Nickel - Normal Spectral Emittance	424
132	Nickel - Normal Spectral Emittance	425
133	Nickel - Normal Spectral Emittance	434
134A	Nickel - Normal Integrated Reflectance	440
134	Nickel - Normal Integrated Reflectance	441
135A(1)	Nickel - Angular Integrated Reflectance	446
135A(2)	Nickel - Angular Integrated Reflectance	447
135	Nickel - Angular Integrated Reflectance	448
136	Nickel - Normal Spectral Reflectance	454
137	Nickel - Angular Spectral Reflectance	457
138*	Nickel - Hemispherical Integrated Absorptance	460
139	Nickel - Normal Spectral Absorptance	462
140	Nickel - Angular Spectral Absorptance	465
141*	Nickel - Hemispherical Solar Absorptance	468
142	Nickel - Normal Solar Absorptance	470
143A	Niobium - Hemispherical Total Emittance	474
143	Niobium - Hemispherical Total Emittance	475
144*	Niobium - Normal Total Emittance	480

Note: Figure number with "A" indicates analyzed data graph.
*No figure

1. ELEMENTS (continued)

Figure and/or Table No.	Material and Sub-property	Page
145	Niobium - Normal Spectral Emittance	482
146A	Niobium - Normal Spectral Emittance	486
146	Niobium - Normal Spectral Emittance	487
147A	Niobium - Normal Spectral Reflectance	492
147	Niboium - Normal Spectral Reflectance	493
148	Niobium - Angular Spectral Absorptance	497
149*	Osmium - Normal Spectral Emittance	500
150*	Palladium - Hemispherical Total Emittance	502
151	Palladium - Normal Total Emittance	504
152	Palladium - Normal Spectral Emittance	507
153*	Palladium - Normal Spectral Emittance	510
154	Palladium - Normal Spectral Emittance	512
155	Palladium - Normal Spectral Absorptance	515
156*	Palladium - Normal Solar Absorptance	518
157	Palladium - Normal Spectral Transmittance	520
158A	Platinum - Hemispherical Total Emittance	524
158	Platinum - Hemispherical Total Emittance	525
159	Platinum - Normal Total Emittance	529
160	Platinum - Normal Spectral Emittance	532
161A	Platinum - Normal Spectral Emittance	536
161	Platinum - Normal Spectral Emittance	537
162	Platinum - Normal Spectral Reflectance	544
163*	Platinum - Angular Spectral Reflectance	547
164*	Platinum - Angular Spectral Reflectance	549
165	Platinum - Normal Spectral Absorptance	551
166	Platinum - Angular Spectral Absorptance	554
167*	Platinum - Normal Solar Absorptance	557
168	Rhenium - Hemispherical Total Emittance	559
169	Rhenium - Normal Total Emittance	562
170	Rhenium - Normal Spectral Emittance	565
171	Rhenium - Normal Spectral Emittance	568
172*	Rhodium - Hemispherical Total Emittance	571
173	Rhodium - Normal Total Emittance	573
174	Rhodium - Normal Spectral Emittance	576
175*	Rhodium - Normal Spectral Emittance	579
176	Rhodium - Normal Spectral Reflectance	581
177	Rhodium - Angular Spectral Reflectance	584
178*	Rhodium - Angular Spectral Absorptance	587
179*	Rhodium - Normal Solar Absorptance	589
180*	Ruthenium - Normal Spectral Emittance	591
181*	Silicon - Normal Total Emittance	593
182*	Silicon - Normal Spectral Emittance	595
183A	Silicon - Normal Spectral Emittance	598
183	Silicon - Normal Spectral Emittance	599
184A	Silicon - Normal Spectral Reflectance	604

Note: Figure number with "A" indicates analyzed data graph.
*No figure

1. ELEMENTS (continued)

Figure and/or Table No.	Material and Sub-property	Page
184	Silicon - Normal Spectral Reflectance	605
185	Silicon - Angular Spectral Reflectance	611
186*	Silicon - Normal Spectral Absorptance	614
187	Silicon - Normal Spectral Transmittance	616
188	Silver - Hemispherical Total Emittance	620
189*	Silver - Normal Total Emittance	623
190*	Silver - Normal Spectral Emittance	625
191*	Silver - Normal Spectral Emittance	627
192A	Silver - Normal Spectral Reflectance	630
192	Silver - Normal Spectral Reflectance	631
193	Silver - Angular Spectral Reflectance	636
194*	Silver - Hemispherical Integrated Absorptance	639
195*	Silver - Normal Spectral Absorptance	641
196*	Silver - Normal Spectral Absorptance	643
197	Silver - Angular Spectral Absorptance	645
198	Silver - Normal Solar Absorptance	648
199	Silver - Normal Spectral Transmittance	651
200A	Tantalum - Hemispherical Total Emittance	654
200	Tantalum - Hemispherical Total Emittance	655
201A	Tantalum - Normal Total Emittance	660
201	Tantalum - Normal Total Emittance	661
202A	Tantalum - Normal Spectral Emittance	666
202	Tantalum - Normal Spectral Emittance	667
203A	Tantalum - Normal Spectral Emittance	672
203	Tantalum - Normal Spectral Emittance	673
204A	Tantalum - Normal Spectral Reflectance	678
204	Tantalum - Normal Spectral Reflectance	679
205	Tantalum - Angular Spectral Reflectance	684
206	Tantalum - Normal Solar Absorptance	687
207	Thallium - Normal Spectral Reflectance	690
208	Thallium - Angular Spectral Reflectance	693
209	Thallium - Normal Spectral Transmittance	696
210*	Thorium - Normal Spectral Emittance	699
211*	Thorium - Normal Spectral Emittance	701
212*	Tin - Hemispherical Total Emittance	703
213*	Tin - Normal Total Emittance	705
214	Tin - Normal Spectral Reflectance	707
215*	Tin - Hemispherical Integrated Absorptance	710
216*	Tin - Normal Integrated Absorptance	712
217	Tin - Normal Spectral Absorptance	714
218	Tin - Angular Spectral Absorptance	717
219	Tin - Normal Spectral Transmittance	720
220	Titanium - Hemispherical Total Emittance	723
221	Titanium - Normal Total Emittance	726

Note: Figure number with "A" indicates analyzed data graph.
*No figure

1. ELEMENTS (continued)

Figure and/or Table No.	Material and Sub-property	Page
222	Titanium - Normal Spectral Emittance	729
223	Titanium - Normal Spectral Emittance	732
224	Titanium - Angular Spectral Emittance	735
225	Titanium - Angular Spectral Emittance	738
226A	Titanium - Normal Spectral Reflectance	744
226	Titanium - Normal Spectral Reflectance	745
227A(1)	Titanium - Angular Spectral Reflectance	751
227A(2)	Titanium - Angular Spectral Reflectance	752
227	Titanium - Angular Spectral Reflectance	753
228*	Titanium - Normal Solar Reflectance	769
229*	Titanium - Angular Spectral Absorptance	771
230*	Titanium - Normal Spectral Transmittance	773
231A	Tungsten - Hemispherical Total Emittance	776
231	Tungsten - Hemispherical Total Emittance	777
232A	Tungsten - Normal Total Emittance	782
232	Tungsten - Normal Total Emittance	783
233A	Tungsten - Normal Spectral Emittance	790
233	Tungsten - Normal Spectral Emittance	791
234A	Tungsten - Normal Spectral Emittance	796
234	Tungsten - Normal Spectral Emittance	797
235*	Tungsten - Angular Spectral Emittance	808
236*	Tungsten - Angular Spectral Emittance	810
237*	Tungsten - Angular Integrated Reflectance	812
238	Tungsten - Normal Spectral Reflectance	814
239A	Tungsten - Normal Spectral Reflectance	818
239	Tungsten - Normal Spectral Reflectance	819
240*	Tungsten - Angular Spectral Reflectance	823
241	Tungsten - Angular Spectral Absorptance	825
242A	Uranium - Hemispherical Total Emittance	828
242	Uranium - Hemispherical Total Emittance	829
243A	Uranium - Normal Spectral Emittance	834
243	Uranium - Normal Spectral Emittance	835
244*	Uranium - Normal Spectral Emittance	838
245A	Uranium - Normal Spectral Emittance	840
245	Uranium - Normal Spectral Emittance	841
246A	Vanadium - Normal Spectral Reflectance	844
246	Vanadium - Normal Spectral Reflectance	845
247*	Vanadium - Angular Spectral Reflectance	848
248	Vanadium - Angular Spectral Absorptance	850
249*	Yttrium - Normal Spectral Emittance	853
250*	Zinc - Hemispherical Total Emittance	855
251*	Zinc - Normal Total Emittance	857
252A	Zinc - Normal Spectral Reflectance	860
252	Zinc - Normal Spectral Reflectance	861

Note: Figure number with "A" indicates analyzed data graph.
*No figure

1. ELEMENTS (continued)

Figure and/or Table No.	Material and Sub-property	Page
253*	Zinc - Hemispherical Integrated Absorptance	864
254	Zinc - Normal Spectral Absorptance	866
255	Zinc - Angular Spectral Absorptance	869
256	Zirconium - Normal Total Emittance	872
257	Zirconium - Normal Spectral Emittance	875
258	Zirconium - Normal Spectral Emittance	878
259*	Zirconium - Normal Spectral Reflectance	881
260	Zirconium - Angular Spectral Absorptance	883

2. BINARY ALLOYS

Figure and/or Table No.	Material and Sub-property	Page
261	Aluminum + Cobalt - Normal Spectral Reflectance	887
262	Aluminum + Magnesium - Normal Spectral Reflectance	890
263	Aluminum + Silicon - Normal Spectral Reflectance	893
264	Aluminum + Silver - Normal Spectral Reflectance	896
265*	Bismuth + Tin - Normal Integrated Absorptance	899
266	Cobalt + Aluminum - Normal Spectral Reflectance	901
267*	Cobalt + Iron - Normal Spectral Emittance	904
268*	Cobalt + Nickel - Normal Spectral Emittance	906
269*	Copper + Nickel - Normal Total Emittance	908
270*	Copper + Tin - Normal Spectral Reflectance	910
271*	Copper + Zinc - Hemispherical Total Emittance	912
272	Copper + Zinc - Normal Total Emittance	914
273	Copper + Zinc - Normal Spectral Reflectance	917
274	Copper + Zinc - Angular Spectral Reflectance	920
275*	Copper + Zinc - Hemispherical Integrated Absorptance	923
276*	Copper + Zinc - Normal Integrated Absorptance	925
277A	Copper + Zinc - Angular Spectral Absorptance	928
277	Copper + Zinc - Angular Spectral Absorptance	929
278	Gold + Silver - Normal Spectral Reflectance	932
279	Iron + Carbon - Normal Total Emittance	935
280*	Iron + Chromium - Normal Spectral Reflectance	938
281*	Iron + Chromium - Angular Spectral Reflectance	940
282	Iron + Nickel - Normal Spectral Emittance	942
283	Iron + Tungsten - Normal Spectral Emittance	945
284*	Lead + Tin - Hemispherical Total Emittance	948
285	Magnesium + Aluminum - Normal Spectral Reflectance	950
286	Molybdenum + Titanium - Normal Total Emittance	953
287	Molybdenum + Titanium - Angular Total Emittance	956
288	Molybdenum + Titanium - Normal Spectral Emittance	959

Note: Figure number with "A" indicates analyzed data graph.
*No figure

Figure and/or Table No.	Material and Sub-property	Page
289A	Molybdenum + Titanium - Normal Spectral Reflectance	962
289	Molybdenum + Titanium - Normal Spectral Reflectance	963
290*	Molybdenum + Tungsten - Hemispherical Total Emittance	967
291	Molybdenum + Tungsten - Normal Spectral Emittance	969
292A	Nickel + Chromium - Normal Spectral Emittance	972
292	Nickel + Chromium - Normal Spectral Emittance	973
293	Nickel + Iron - Normal Spectral Emittance	976
294*	Nickel + Silver - Normal Total Emittance	979
295	Niobium + Tungsten - Hemispherical Total Emittance	981
296	Niobium + Tungsten - Normal Spectral Emittance	984
297A	Niobium + Zirconium - Hemispherical Total Emittance	988
297	Niobium + Zirconium - Hemispherical Total Emittance	989
298*	Niobium + Zirconium - Normal Total Emittance	992
299	Niobium + Zirconium - Normal Spectral Emittance	994
300*	Platinum + Rhodium - Hemispherical Total Emittance	997
301A	Platinum + Rhodium - Normal Total Emittance	1000
301	Platinum + Rhodium - Normal Total Emittance	1001
302	Platinum + Rhodium - Normal Spectral Emittance	1004
303*	Silver + Aluminum - Normal Spectral Reflectance	1007
304	Silver + Aluminum - Angular Spectral Reflectance	1009
305	Silver + Beryllium - Angular Spectral Reflectance	1012
306	Silver + Gold - Normal Spectral Reflectance	1015
307	Silver + Silicon - Angular Spectral Reflectance	1018
308	Tantalum + Tungsten - Normal Total Emittance	1021
309*	Tantalum + Tungsten - Normal Spectral Emittance	1024
310*	Tin + Indium - Normal Integrated Absorptance	1026
311A	Titanium + Manganese - Normal Total Emittance	1028
311	Titanium + Manganese - Normal Total Emittance	1029
312A	Titanium + Manganese - Normal Spectral Emittance	1032
312	Titanium + Manganese - Normal Spectral Emittance	1033
313A	Titanium + Manganese - Normal Spectral Reflectance	1036
313	Titanium + Manganese - Normal Spectral Reflectance	1037
314*	Titanium + Manganese - Normal Solar Absorptance	1041
315*	Tungsten + Molybdenum - Hemispherical Total Emittance	1043
316	Tungsten + Molybdenum - Normal Spectral Emittance	1045
317	Tungsten + Rhenium - Hemispherical Total Emittance	1048
318*	Tungsten + Rhenium - Normal Spectral Emittance	1051
319	Uranium + Niobium - Hemispherical Total Emittance	1053
320	Uranium + Niobium - Normal Spectral Emittance	1056
321*	Zinc + Aluminum - Normal Spectral Reflectance	1059

Note: Figure number with "A" indicates analyzed data graph.
*No figure

3. MULTIPLE ALLOYS

Figure and/or Table No.	Material and Sub-property	Page
322	Aluminum + Copper + ΣX_i - Hemispherical Total Emittance	1062
323A	Aluminum + Copper + ΣX_i - Normal Total Emittance	1066
323	Aluminum + Copper + ΣX_i - Normal Total Emittance	1067
324A	Aluminum + Copper + ΣX_i - Normal Spectral Emittance	1072
324	Aluminum + Copper + ΣX_i - Normal Spectral Emittance	1073
325A	Aluminum + Copper + ΣX_i - Normal Spectral Reflectance	1076
325	Aluminum + Copper + ΣX_i - Normal Spectral Reflectance	1077
326	Aluminum + Copper + ΣX_i - Normal Solar Reflectance	1083
327	Aluminum + Copper + ΣX_i - Normal Solar Absorptance	1086
328A	Aluminum + Iron + ΣX_i - Normal Spectral Reflectance	1090
328	Aluminum + Iron + ΣX_i - Normal Spectral Reflectance	1091
329	Aluminum + Iron + ΣX_i - Normal Solar Reflectance	1094
330*	Aluminum + Magnesium + ΣX_i - Hemispherical Total Emittance	1098
331	Aluminum + Magnesium + ΣX_i - Normal Total Emittance	1100
332A	Aluminum + Magnesium + ΣX_i - Normal Spectral Reflectance	1104
332	Aluminum + Magnesium + ΣX_i - Normal Spectral Reflectance	1105
333*	Aluminum + Magnesium + ΣX_i - Normal Solar Absorptance	1110
334*	Aluminum + Manganese + ΣX_i - Hemispherical Total Emittance	1112
335*	Aluminum + Manganese + ΣX_i - Normal Total Emittance	1114
336*	Aluminum + Zinc + ΣX_i - Hemispherical Total Emittance	1116
337A	Aluminum + Zinc + ΣX_i - Normal Total Emittance	1118
338	Aluminum + Zinc + ΣX_i - Normal Spectral Emittance	1121
339A	Aluminum + Zinc + ΣX_i - Angular Spectral Emittance	1124
339	Aluminum + Zinc + ΣX_i - Angular Spectral Emittance	1125
340	Aluminum + Zinc + ΣX_i - Normal Solar Reflectance	1128
341	Aluminum + Zinc + ΣX_i - Normal Solar Absorptance	1131
342	Beryllium + Iron + ΣX_i - Angular Spectral Reflectance	1134
343A	Cobalt + Chromium + ΣX_i - Hemispherical Total Emittance	1138
343	Cobalt + Chromium + ΣX_i - Hemispherical Total Emittance	1139
344	Cobalt + Chromium + ΣX_i - Normal Total Emittance	1142
345	Cobalt + Chromium + ΣX_i - Normal Spectral Emittance	1145
346	Cobalt + Chromium + ΣX_i - Normal Spectral Emittance	1148
347A	Cobalt + Chromium + ΣX_i - Normal Spectral Reflectance	1152
347	Cobalt + Chromium + ΣX_i - Normal Spectral Reflectance	1153
348A	Copper + Aluminum + ΣX_i - Normal Total Emittance	1158
348	Copper + Aluminum + ΣX_i - Normal Total Emittance	1159
349	Copper + Aluminum + ΣX_i - Normal Spectral Emittance	1162
350	Copper + Aluminum + ΣX_i - Normal Spectral Reflectance	1166
351	Copper + Aluminum + ΣX_i - Normal Solar Absorptance	1169
352*	Copper + Nickel + ΣX_i - Normal Spectral Reflectance	1172
353	Copper + Tin + ΣX_i - Normal Spectral Reflectance	1174
354A	Iron + Chromium + ΣX_i - Normal Total Emittance	1178
354	Iron + Chromium + ΣX_i - Normal Total Emittance	1179
355A	Iron + Chromium + ΣX_i - Normal Spectral Emittance	1184

Note: Figure number with "A" indicates analyzed data graph.
*No figure

3. MULTIPLE ALLOYS (continued)

Figure and/or Table No.	Material and Sub-property	Page
355	Iron + Chromium + ΣX_i - Normal Spectral Emittance	1185
356A	Iron + Chromium + ΣX_i - Normal Spectral Emittance	1190
356	Iron + Chromium + ΣX_i - Normal Spectral Emittance	1191
357A	Iron + Chromium + ΣX_i - Normal Spectral Reflectance	1196
357	Iron + Chromium + ΣX_i - Normal Spectral Reflectance	1197
358	Iron + Chromium + ΣX_i - Normal Spectral Absorptance	1203
359	Iron + Chromium + ΣX_i - Normal Solar Absorptance	1206
360A	Iron + Chromium + Nickel + ΣX_i - Hemispherical Total Emittance	1210
360	Iron + Chromium + Nickel + ΣX_i - Hemispherical Total Emittance	1211
361A(1)	Iron + Chromium + Nickel + ΣX_i - Normal Total Emittance	1217
361A(2)	Iron + Chromium + Nickel + ΣX_i - Normal Total Emittance	1218
361A(3)	Iron + Chromium + Nickel + ΣX_i - Normal Total Emittance	1219
361	Iron + Chromium + Nickel + ΣX_i - Normal Total Emittance	1220
362*	Iron + Chromium + Nickel + ΣX_i - Angular Total Emittance	1231
363A	Iron + Chromium + Nickel + ΣX_i - Normal Spectral Emittance	1234
363	Iron + Chromium + Nickel + ΣX_i - Normal Spectral Emittance	1235
364A	Iron + Chromium + Nickel + ΣX_i - Normal Spectral Emittance	1242
364	Iron + Chromium + Nickel + ΣX_i - Normal Spectral Emittance	1243
365A	Iron + Chromium + Nickel + ΣX_i - Angular Spectral Emittance	1252
365	Iron + Chromium + Nickel + ΣX_i - Angular Spectral Emittance	1253
366A(1)	Stainless Steel 303 - Angular Spectral Emittance	1256
366A(2)	Stainless Steel 303 - Angular Spectral Emittance	1257
367A	Iron + Chromium + Nickel + ΣX_i - Normal Spectral Reflectance	1264
367	Iron + Chromium + Nickel + ΣX_i - Normal Spectral Reflectance	1265
368*	Iron + Chromium + Nickel + ΣX_i - Angular Spectral Reflectance	1283
369*	Iron + Chromium + Nickel + ΣX_i - Angular Spectral Reflectance	1285
370	Iron + Chromium + Nickel + ΣX_i - Normal Solar Reflectance	1287
371*	Iron + Chromium + Nickel + ΣX_i - Hemispherical Integrated Absorptance	1291
372	Iron + Chromium + Nickel + ΣX_i - Normal Spectral Absorptance	1293
373	Iron + Chromium + Nickel + ΣX_i - Angular Spectral Absorptance	1296
374	Iron + Chromium + Nickel + ΣX_i - Normal Solar Absorptance	1299
375*	Iron + Manganese + ΣX_i - Hemispherical Total Emittance	1305
376*	Iron + Manganese + ΣX_i - Normal Total Emittance	1307
377	Iron + Manganese + ΣX_i - Normal Solar Absorptance	1309
378	Iron + Nickel + ΣX_i - Normal Spectral Reflectance	1312
379A	Iron + Nickel + Chromium + ΣX_i - Hemispherical Total Emittance	1316
379	Iron + Nickel + Chromium + ΣX_i - Hemispherical Total Emittance	1317
380A	Iron + Nickel + Chromium + ΣX_i - Normal Spectral Emittance	1320
380	Iron + Nickel + Chromium + ΣX_i - Normal Spectral Emittance	1321
381	Iron + Nickel + Chromium + ΣX_i - Normal Spectral Reflectance	1324
382	Magnesium + Aluminum + ΣX_i - Normal Total Emittance	1327
383A	Magnesium + Uranium + ΣX_i - Normal Spectral Reflectance	1330
383	Magnesium + Uranium + ΣX_i - Normal Spectral Reflectance	1331
384*	Magnesium + Aluminum + ΣX_i - Normal Solar Absorptance	1334

Note: Figure number with "A" indicates analyzed data graph.
*No figure

3. MULTIPLE ALLOYS (continued)

Figure and/or Table No.	Material and Sub-property	Page
385*	Magnesium + Thorium + ΣX_i - Normal Total Emittance	1336
386*	Magnesium + Thorium + ΣX_i - Normal Spectral Reflectance	1338
387*	Magnesium + Thorium + ΣX_i - Normal Solar Absorptance	1340
388A	Nickel + Chromium + ΣX_i - Hemispherical Total Emittance	1342
388	Nickel + Chromium + ΣX_i - Hemispherical Total Emittance	1343
389A(1)	Nickel + Chromium + ΣX_i - Normal Total Emittance	1347
389A(2)	Nickel + Chromium + ΣX_i - Normal Total Emittance	1348
389	Nickel + Chromium + ΣX_i - Normal Total Emittance	1349
390A	Nickel + Chromium + ΣX_i - Normal Spectral Emittance	1356
390	Nickel + Chromium + ΣX_i - Normal Spectral Emittance	1357
391A(1)	Nickel + Chromium + ΣX_i - Normal Spectral Emittance	1360
391A(2)	Nickel + Chromium + ΣX_i - Normal Spectral Emittance	1361
391	Nickel + Chromium + ΣX_i - Normal Spectral Emittance	1362
392A(1)	Nickel + Chromium + ΣX_i - Normal Spectral Reflectance	1374
392A(2)	Nickel + Chromium + ΣX_i - Normal Spectral Reflectance	1375
392	Nickel + Chromium + ΣX_i - Normal Spectral Reflectance	1376
393	Nickel + Chromium + ΣX_i - Normal Solar Reflectance	1392
394	Nickel + Chromium + ΣX_i - Normal Spectral Absorptance	1395
395*	Nickel + Chromium + ΣX_i - Angular Spectral Absorptance	1398
396	Nickel + Chromium + ΣX_i - Normal Solar Absorptance	1400
397*	Nickel + Cobalt + ΣX_i - Hemispherical Total Emittance	1404
398	Nickel + Cobalt + ΣX_i - Normal Spectral Emittance	1406
399A	Nickel + Cobalt + ΣX_i - Normal Spectral Emittance	1410
399	Nickel + Cobalt + ΣX_i - Normal Spectral Emittance	1411
400A	Nickel + Cobalt + ΣX_i - Normal Spectral Reflectance	1416
400	Nickel + Cobalt + ΣX_i - Normal Spectral Reflectance	1417
401*	Nickel + Copper + ΣX_i - Hemispherical Total Emittance	1423
402A	Nickel + Copper + ΣX_i - Normal Total Emittance	1426
402	Nickel + Copper + ΣX_i - Normal Total Emittance	1427
403	Nickel + Copper + ΣX_i - Normal Spectral Reflectance	1430
404	Nickel + Copper + ΣX_i - Normal Solar Reflectance	1433
405	Nickel + Copper + ΣX_i - Normal Solar Absorptance	1436
406	Nickel + Iron + ΣX_i - Normal Spectral Emittance	1439
407A	Nickel + Molybdenum + ΣX_i - Hemispherical Total Emittance	1442
407	Nickel + Molybdenum + ΣX_i - Hemispherical Total Emittance	1443
408A	Nickel + Molybdenum + ΣX_i - Normal Total Emittance	1446
408	Nickel + Molybdenum + ΣX_i - Normal Total Emittance	1447
409A	Nickel + Molybdenum + ΣX_i - Normal Spectral Emittance	1450
409	Nickel + Molybdenum + ΣX_i - Normal Spectral Emittance	1451
410	Nickel + Molybdenum + ΣX_i - Normal Spectral Reflectance	1454
411	Nickel + Molybdenum + ΣX_i - Normal Solar Absorptance	1457
412*	Niobium + Molybdenum + ΣX_i - Normal Total Emittance	1460
413A	Niobium + Tantalum + ΣX_i - Hemispherical Total Emittance	1462
413	Niobium + Tantalum + ΣX_i - Hemispherical Total Emittance	1463

Note: Figure number with "A" indicates analyzed data graph.
*No figure

3. MULTIPLE ALLOYS (continued)

Figure and/or Table No.	Material and Sub-property	Page
414	Niobium + Tantalum + ΣX_i - Normal Spectral Emittance	1466
415	Niobium + Tungsten + ΣX_i - Hemispherical Total Emittance	1469
416	Silver + Cadmium + ΣX_i - Angular Spectral Reflectance	1472
417	Silver + Copper + ΣX_i - Angular Spectral Reflectance	1475
418	Silver + Zinc + ΣX_i - Angular Spectral Reflectance	1478
419*	Tantalum + Tungsten + ΣX_i - Hemispherical Total Emittance	1481
420	Titanium + Aluminum + ΣX_i - Hemispherical Total Emittance	1483
421A	Titanium + Aluminum + ΣX_i - Normal Total Emittance	1486
421	Titanium + Aluminum + ΣX_i - Normal Total Emittance	1487
422A	Titanium + Aluminum + ΣX_i - Normal Spectral Emittance	1490
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432	Zirconium + Tin + ΣX_i - Normal Spectral Emittance	1522
433	Zirconium + Uranium + ΣX_i - Hemispherical Total Emittance	1525
434	Zirconium + Uranium + ΣX_i - Normal Spectral Emittance	1528

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13. ABSTRACT
This technical report covers work in a continuing systematic program on the thermophysical properties of materials involving the literature search, acquisition, codification, and organization, and data extraction, compilation, evaluation, correlation, analysis, and synthesis, the preparation of "intermediate tables" presenting the total available experimental information, and the final preparation of internally consistent tables of "best data" referred to as "Tables of Recommended Reference Values." The work reported on consists of both data tables projects and scientific documentation efforts. The data tables projects are on the thermal conductivity, specific heat, thermal radiative properties (emittance, reflectance, absorptance, transmittance), thermal diffusivity, and thermal linear and volumetric expansion of elements, ferrous and nonferrous alloys, intermetallic, semiconducting, and nonmetallic compounds, cermets, ceramics, mixtures, composites, systems, polymers, etc., and on the thermal conductivity, specific heat, and viscosity of fluids and fluid mixtures. Property data are presented in both tabular and graphical forms, with accompanying tables giving specifications and characterizations of the test specimens for the data. The resulting data tables are disseminated at large through the 13-volume TPRC DATA SERIES published commercially. This report does not contain the completed thousands of data sheets, but does reproduce in the Appendix, the Table of Contents and the Grouping of Materials and List of Figures and Tables for each of the first 7 volumes (which contain over 8000 pages) of the TPRC DATA SERIES to show the scope of their coverage. In scientific documentation, the scope is broader. TPRC covers all materials and maintains cognizance over 16 thermophysical properties (six more than mentioned above). There are now 55700 references in TPRC's automated Information Storage and Retrieval System. The resulting information on research literature is disseminated through the THERMOPHYSICAL PROPERTIES RESEARCH LITERATURE RETRIEVAL GUIDE, published commercially.

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14. KEY WORDS	LINK A ROLE	LINK A WT	LINK B ROLE	LINK B WT	LINK C ROLE	LINK C WT
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Thermal Conductivity						
Accommodation Coefficient						
Thermal Contact Resistance						
Thermal Diffusivity						
Specific Heat						
Viscosity						
Emittance						
Reflectance						
Absorptance						
Transmittance						
Absorptance to Emittance Ratio						
Prandtl Number						
Diffusion Coefficient						
Thermal Linear Expansion Coefficient						
Thermal Volumetric Expansion Coefficient						
Surface Tension						
Solids						
Liquids						
Gases						
Elements						
Metals						
Molten Metals						
Semimetals						
Semiconductors						
Nonmetals						
Graphites						
Alloys						
Intermetallics						
Compounds						
Mixtures						
Refractories						
Ceramics						
Cermets						
Composites						
Systems						
Polymers						
Coatings						
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Data Tables						
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