Mines Branch Information Circular IC 118

DIRECTORY AND BIBLIOGRAPHY OF HIGH TEMPERATURE CONDENSED STATES RESEARCH IN CANADA AND ELSEWHERE, JANUARY TO MARCH, 1960

by

Norman F.H. Bright*

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SYNOPSIS

This is the second quarterly bulletin of information on high temperature work. It contains a bibliography of work on high temperature condensed states published in Canadian journals during the period January to March, 1960. Also included are directories of laboratories in the United States and certain Scandinavian countries where work in this field is being prosecuted, together with the names of the people involved and the particular areas of their endeavour.

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*Head, Physical Chemistry Section, Mineral Sciences Division, Mines Branch, Department of Mines and Technical Surveys, Ottawa, Canada.

Direction des mines
Circulaire d'information IC 118

RÉPERTOIRE ET BIBLIOGRAPHIE DES RECHERCHES EFFECTUÉES DANS LE DOMAINE DES ÉTATS CONDENSÉS AUX TEMPÉRATURES ÉLEVÉES, AU CANADA ET AILLEURS, DE JANVIER À MARS 1960

par

Norman F.H. Bright*

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RÉSUMÉ

Voici le second bulletin trimestriel d'information sur les travaux exécutés dans le domaine des températures élevées. Il contient une bibliographie des travaux exécutés dans le domaine des états condensés aux températures élevées et à l'égard desquels on a publié des rapports dans les revues techniques canadiennes au cours de la période comprise entre janvier et mars 1960. On y trouvera aussi la liste de laboratoires aux États-Unis et dans certains pays scandinaves, où s'effectuent certains travaux de ce genre, ainsi que le nom des chercheurs en cause et des domaines particuliers qui les intéressent.

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CONTENTS

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INTRODUCTION

This report represents a continuation of the material contained in Mines Branch Information Circular IC 117, published in March, 1960, wherein it was stated that it was the intention to publish quarterly bulletins of information on research in the high temperature condensed states field. This is the second such quarterly bulletin.

In the present circular, the following sections are included:-

(1) The results of a literature search through journals published in Canada during the period January to March, 1960 dealing with this field of chemistry; it should again be noted that work published by Canadian authors in journals of other countries is not included within the scope of this survey.

(2) A list of laboratories in the United States where work on high temperature condensed states is conducted. As in the previous Information Circular, this list is subdivided according to the type of work involved. The list includes the names of the researchers at the various institutions mentioned, together with a brief mention of their specific fields of interest. This information was supplied to the writer by Dr. Raymond F. Walker of the Refractories Section of the National

Bureau of Standards, Washington, D.C.

(3) A similar list of laboratories and researchers engaged in this field of work in certain Scandinavian countries. This information was supplied by Professor Gunnar Hagg, of the University of Uppsala, Sweden.

Again, as in the case of the previous Information Circular, the writer would appreciate being advised of any errors or omissions in the various sections of the present document. Such information should be sent to him at the following address:-

Dr. Norman F.H. Bright,
Head, Physical Chemistry Section,
Mineral Sciences Division,
Mines Branch,
Department of Mines and Technical Surveys,
Ottawa, Canada.

PART I

BIBLIOGRAPHY OF WORK ON HIGH TEMPERATURE CONDENSED STATES, PUBLISHED IN CANADA IN JANUARY-MARCH, 1960

Commission on High Temperatures

of the

International Union of Pure and Applied Chemistry
(Sub-Commission on Condensed States)

Bibliography (January, February, March, 1960)

for Canada

(collected by Dr. Norman F.H. Bright, Mines Branch, Ottawa)

A. Devices for Achieving High Temperatures

1. High-temperature Kiln Improves Zirconia Product.
J.G. MacCallum
Canadian Metalworking, Vol. 23, No. 4, (1960), pp. 42-43.

B. Devices for Measuring and Controlling High Temperatures

nil

C. Devices for Physical Measurements at High Temperatures

1. The Freezing Points of High Purity Metals as Precision Temperature Standards. V. Thermal Analyses on 10 Samples of Tin with Purities Greater than 99.99 + %.
E.H. McLaren and E.G. Murdock
Canadian Journal of Physics, Vol. 38, (1960), pp. 100-118.

D. Properties of Refractory Phases and Systems Studied at Lower Temperatures

a) Metallic Systems

1. Rates of Adsorption of Hydrogen on Palladium and on Rhodium.
Manfred J.D. Low
Canadian Journal of Chemistry, Vol. 38, (1960), pp. 588-595.

b) Non-metallic Systems

1. Arsenides of the Transition Metals. III. A Note on the Higher Arsenides of Iron, Cobalt and Nickel.
   R.D. Heyding and L.D. Calvert
   Canadian Journal of Chemistry, Vol. 38, (1960), pp. 313-316.

2. Solubilities of $TiCl_4$ in Mixtures of KCl-NaCl and the Electrode Potentials of the Titanium Chlorides in 1/1 (Mole) KCl-NaCl Solutions.
   S.N. Flengas
   Mines Branch Research Report R 50; January, 1960, Department of Mines and Technical Surveys, Ottawa.

3. Nuclear Grade Uranium Tetrafluoride by the Moving Bed Process.
   F.H. Hueston
   Canadian Journal of Chemical Engineering, Vol. 38, (1960), pp. 29-32.

E. Properties and Uses of Refractory Phases and Systems at High Temperatures

a) Metallic Systems

1. Beryllium may Clad our Nuclear Fuel.
   W.D. Bennett
   Canadian Chemical Processing, Vol. 44, No. 4, (1960), p. 69.

2. Isolation of the Rare Earth Elements.
   J.B. Zimmerman and J.C. Ingles
   Mines Branch Research Report R 61; March, 1960, Department of Mines and Technical Surveys, Ottawa.

3. Radical Technique "grows" Complete Circuits from Semi-conductors.
   S.W. Herwald
   Canadian Electronics Engineering, Vol. 4, No. 3, (1960), pp. 33-39.

4. The Effect of Deformation on the Internal Friction of Iron, Measured at the Carbon Peak Position.
   F.W.C. Boswell
   Canadian Journal of Physics, Vol. 37, (1959), pp. 1474-1481.

5. Liquid-Solid Interface Shape Observed in Silicon Crystals Grown by the Czochralski Method.
   W.D. Edwards
   Canadian Journal of Physics, Vol. 38, (1960), pp. 439-443.

b) Non-metallic Systems

1. Fabricating Nuclear Fuel Rods for Canada's Reactors.
   H.S. Milne
   Canadian Metalworking, Vol. 23, No. 2, (1960), pp. 24-29.

F. Properties of Non-Refractory Phases and Systems at High Temperatures

nil

G. Phase Equilibria

nil

H. Reactions (Physical and Chemical) at High Temperatures

1. High-energy Rate Forming of Metals.
   H.P. Tardif
   Canadian Metalworking, Vol. 23, No. 4, (1960), pp. 24-28.

2. Decomposition of Zinc Oxide.
   E.A. Secco
   Canadian Journal of Chemistry, Vol. 38, (1960), pp. 596-601.

3. The Incorporation of Fission Products into Glass for Disposal.
   A.R. Bancroft
   Canadian Journal of Chemical Engineering, Vol. 38, (1960), pp. 19-24.

PART II

LIST OF LABORATORIES IN THE UNITED STATES

active in

RESEARCH ON CONDENSED STATES

AT

HIGH TEMPERATURES

This information has been supplied by:

Dr. Raymond F. Walker,
Refractories Section,
National Bureau of Standards,
Washington, 25, D.C.,
U.S.A.

International Union of Pure and Applied Chemistry
Commission on High Temperatures and Refractories
Sub-Commission on Condensed States

LIST OF LABORATORIES IN THE UNITED STATES

active in

RESEARCH ON FUSED SALTS

Name and Address of Institution	Personnel	Properties and Chemical Systems being Studied
Aluminum Company of America, Alcoa Research Laboratories, P.O. Box 772, New Kensington, Pa.	P.A. Foster J.J. Stokes W.B. Frank L.M. Foster	Cryolite and systems of interest to Aluminum Industry.
Argonne National Laboratory, Lemont, Illinois.	D.M. Gruen Nadine Isaac Robert McBeth Carol Slana Conrad Thalmayer Eric Iberson	Spectroscopy of fused salt systems. Visible, infrared; complex ions, oxidation states, acid-base reactions, kinetics. Electrochemistry of fused salt systems. Redox potentials, chronopotentiometry. Crystal growth from fused salt systems. Metals, refractory oxides, sulfides, borides, etc. Solution chemistry in fused salt systems. Solvent extractions, precipitation reactions, metathesis reactions.
Battelle Memorial Institute, 505 King Avenue, Columbus 1, Ohio.	C.L. Faust L.D. McGraw	Electrolysis in fused salt system.

Name and Address of Institution	Personnel	Properties and Chemical Systems being Studied
The Carborundum Company, Carborundum Metals Co. Inc., Akron, New York.	D.R. Spink	Metal chlorides
Massachusetts Institute of Technology, Dept. of Metallurgy, Cambridge, Mass.	J. Chipman J.F. Elliott T.B. King	$CaO-SiO_2-Al_2O_3$ $CaO-MgO-SiO_2-Al_2O_3$ $CaO-FeO-Fe_2O_3-SiO_2$
Massachusetts Institute of Technology, Laboratory for Insulation Research, 77 Massachusetts Avenue, Cambridge 39, Mass.	Alexander Smakula	
National Carbon Company, Research Laboratories, Division of Union Carbide Corporation, P.O. Box 6116, Cleveland 1, Ohio.	S. Senderoff L.M. Litz	Molten halide mixtures; metals dissolved in molten salts. Determination of physical properties such as viscosity, density, conductivity, optical behaviour, etc.; study of chemical reactivity including electrochemistry, thermodynamics (especially electrode potentials), and reaction kinetics.
National Lead Company, Titanium Div. Research Lab., Box 58, South Amboy, N.J.	O.W. Moles L.W. Gendvil W.R. Opie	$NaCl-TiCl_2-TiCl_3$ $KCl-NaCl-TiCl_2-TiCl_3$ $NaCl-ZrCl_2-ZrCl_3$

Name and Address of Institution	Personnel	Properties and Chemical Systems being Studied
New York College of Ceramics, Alfred University, Alfred, New York.	T.J. Gray (Total group 24) C.E. Myers	Transport phenomena in molten electrolytes in conjunction with high temperature fuel cells. Interaction and corrosion between molten electrolytes and metals and ceramics. Fused pyrophosphates, meta -phosphates, orthophos- phates, alkali metal salts.
The Pennsylvania State University, Dept. of Chemistry, Analytical Laboratories, University Park, Pa.	J. Jordan E.J. Billingham, Jr. J. Pendergrast K. Romberger	Thermochemical titrations and polarography. Stoichiometry, enthalpies, free energies, and entropies. Precipitation, complexation and oxidation-reduction processes.
Pennsylvania State University, University Park, Pa.	J. Short H. Cohen R. Roy	All combinations of alkali halides. CaF_2-SrF_2-YF_3-LaF_3
Stanford Research Institute, Menlo Park, California.	D. Cubicciotti F. Keneshea T. Milne	Solution of metals dissolved in molten salts. Evaporation of molten salts.
Temple University, Research Institute, 4150 Henry Avenue, Philadelphia 44, Pa.	A.V. Grosse A.D. Kirshenbaum J.A. Cahill	Alkaline earth fluorides including magnesium fluoride (Group II A). Rare earth fluorides. Aluminum oxide. Silicon dioxide.

Name and Address of Institution	Personnel	Properties and Chemical Systems being Studied
U.S. Bureau of Mines, Electrotechnical Experiment Station, P.O. Box 217, Norris, Tennessee.	Gilbert Farrior	Chlorides-fluorides (with borides)
United States Steel Corp., Fundamental Research Lab., Research Centre, Monroeville, Pa.	B.M. Larsen L.O. Sordahl	Systems related to the Open Hearth furnace practice.
Westinghouse Research Laboratories, Beulah Road, Churchill Boro., Pittsburgh 35, Pa.	E.W. Johnson	Sulfides and oxides of transition metals. Oxides.

International Union of Pure and Applied Chemistry
Commission on High Temperatures and Refractories
Sub-Commission on Condensed States

LIST OF LABORATORIES IN THE UNITED STATES

active in

RESEARCH ON SINGLE CRYSTAL GROWTH ABOVE 1000°C

Name and Address of Institution	Personnel	Chemical Systems being Studied
Air Force Cambridge Research Center, Bedford, Mass.	W.G. Field Carl Pitha	Growing of ferromagnetic garnets from fused salt melts. Growing of sapphires by flame fusion.
	J.R. O' Connor	Growing of single crystals of silicon. Studies on growth perfection. Studies on interfacial energies (vapor, liquid, solid) of silicon and other semiconductors.
	J. Smiltens	Growing of single crystals of silicon carbide.
Aluminum Company of America, Alcoa Research Laboratories, P.O. Box 772, New Kensington, Pa.	G. Long L.M. Foster R.A. Kramer	Al_4C_3 Graphite Al_2O_3 AlN Ga GaAs
Atomics International, A Division of North American Aviation, Inc., P.O. Box 309, Canoga Park, California.	R. Chang	Intermetallic compounds and metalloids, except oxides.

Name and Address of Institution	Personnel	Chemical Systems being Studied
Battelle Memorial Institute, 505 King Avenue, Columbus 1, Ohio.	J.F. Miller	Copper, rare-earth selenides, sulfides, tellurides, nitrides, and silicides.
	J.F. Miller S.E. Miller W.P. Allred B. Paris J.I. Genco J.W. Moody E.P. Stambaugh	III-V Group compounds and alloys such as GaP, InP, GaP-InP, GaAs-AlAs, AlAs, GaAs, AlSb.
	W.P. Allred	Noble metals and alloys and silicon.
	P.D. Frost	Te
	J.A. DeMastry	Mo
	B.C. Allen	W and Pt
Bell Telephone Laboratories Incorporated, Murray Hill, New Jersey.	J.W. Nielsen J.P. Remeika E. Buehler	Crystal growth of transition metal oxides, ferrites, magnetic garnets, ferro-electrics from molten salts. Growth of silicon.
Bureau of Mines, Albany Metallurgy Research Center, Box 495, Albany, Oregon.	H. Kato L. Bazant G. Asai	Zone refining of refractory metals.
The Carborundum Company, Research and Development Division, Niagara Falls, New York.	H.D. Batha W. Robinson W.D. McKee, Jr.	Silicon carbide. Refractory oxides.
General Electric Company, Metallurgy and Ceramics Research Dept., P.O. Box 1088, Schenectady, New York.	R.C. DeVries G.W. Sears W.F. Moore	Tungsten bronzes $BaTiO_3$ Al_2O_3 Pure metals SiO_2

Name and Address of Institution	Personnel	Chemical Systems being Studied
Hughes Aircraft Company, Research Laboratories, Florence and Teale Streets, Culver City, California.	Robert A. Lefever Juanita W. Torpy M.K. Jack	Currently - Y and rare earth iron and silicate garnets by flux and flame fusion methods. Al_2O_3 and spinel (both containing transition and rare earth impurities) and ferrites by flame fusion. Near future - Hydrothermal, Czochralski methods. Exploratory work on MgO, ThO_2, ZrO_2, and rare earth oxides. Perfection and growth mechanisms.
International Business Machines Corporation, Research Laboratory, Boardman Road, Box 390, Poughkeepsie, New York.	M.W. Shafer E.A. Giess	Transition metal ferrite systems (spinel crystals). Rare earth garnet systems.
Lawrence Radiation Laboratory, Chemistry Division, Bldg. 101, P.O. Box 808, Livermore, California.	Edward Catalano	Co and Ni fluorides.
Arthur D. Little, Inc., Acorn Park, Cambridge 40, Mass.	E.P. Flint J.L. Sienczyk	Magnesium oxide.
Massachusetts Institute of Technology, Laboratory for Insulation Research, 77 Massachusetts Avenue, Cambridge 39, Mass.	Alexander Smakula	

Name and Address of Institution	Personnel	Chemical Systems being Studied
National Bureau of Standards, Washington 25, D.C. Mineral Products Division Metallurgy Division	A. Van Valkenburg C.E. Weir W.S. Brower T.H. Orem	$BeO.Al_2O_3.SiO_2$ $MgO.SiO_2.F_2$ Mixed Ba and Sr titanates. Titanates with controlled impurities. Copper and aluminum
National Carbon Company, Research Laboratories, Division of Union Carbide Corporation, P.O. Box 6116, Cleveland 1, Ohio.	R.D. Westbrook R. Didchenko R. Bacon	Silicon Carbides Graphite Super-refractories
National Lead Company, Titanium Div. Research Laboratories, Box 58, South Amboy, N.J.	L. Merker V.J. Cobb R. Koss F. Balon M.D. Beals W.R. Opie L. Lynd	TiO_2, $CaO.TiO_2$ $SrO.TiO_2$, $BaO.TiO_2$-$SrO.TiO_2$, $BaO.TiO_2$-$CaO.TiO_2$, ZnO-TiO_2, ZrO-TiO_2, Al_2O_3-TiO_2, CaO-WO_3, Al_2O_3-La_2O_3, Tungstates, Aluminates.
New York College of Ceramics, Alfred University, Alfred, New York.	T.J. Gray G. Post G. Lewis	Oxides, sulfides, selenides, tellurides, phosphides, and arsenides of cadmium, zinc and transition metals, including bismuth.
Owens-Illinois Technical Center, Fundamental Research Section, 1700 N. Westwood Avenue, Toledo, Ohio.	S.M. Lang	

Name and Address of Institution	Personnel	Chemical Systems being Studied
Portland Cement Assoc. Fellowship, National Bureau of Standards, Washington 25, D.C.	Fred Ordway Deane K. Smith	$3CaO.Al_2O_3$ $3CaO.SiO_2$ $2CaO.SiO_2$ $2CaO.(Fe_2O_3, Al_2O_3)$
Raytheon Co., Research Division, Solid State Physics Group, Waltham, Massachusetts.	A.E. Paladino (now at M.I.T.) H.S. van Hook	Fe-Y-O
Servomechanisms, Inc., Santa Barbara Airport, Goleta, California.	R.F. Redemske	ZrO_2, etc.
Stanford Research Institute, Menlo Park, California.	F.A. Halden L.E. Sobon	B-silicon carbide from solution in molten alloys. Oxides (Al_2O_3, TiO_2, ferrites) by Verneuil process in controlled atmospheres with arc image furnace. $TaSi_2$, carbides, nitrides by Verneuil process.
U.S. Army Signal Research and Development Laboratory, Fort Monmouth, New Jersey.		Ferrites
U.S. Bureau of Mines, Eastern Experiment Station, College Park, Maryland.	Dr. Herbert H. Greger Louis P. Domingues	Oxides of Groups III and IV and including the rare earth series.
University of Kansas, Department of Chemistry, Lawrence, Kansas.	Paul W. Gilles Ernest R. Plante Warren A. Knarr Stanley Killingbeck J.G.L. Wall Phillip G. Wahlbeck Hugo F. Franzen P. Kent Smith	Molybdenum-oxygen Tungsten-oxygen Titanium-oxygen Vanadium-oxygen Silicon-boron Rare earth-boron

Name and Address of Institution	Personnel	Chemical Systems being Studied
U.S. Bureau of Mines, Electrotechnical Experiment Station, P.O. Box 217, Norris, Tennessee.	Perry G. Cotter H.R. Shell N.A. Pace	Carbides, borides, nitrides, silicides. Synthetic fluorphlogopite mica; other substituted fluormicas; fluoramphiboles; other minerals in fluor-silicate systems; inorganic crystalline fibres (in any system).
United States Steel Corp., Fundamental Research Lab., Research Center, Monroeville, Pa.	E.W. Troy	Fe-Al Fe-Si Pure iron
University of Utah, Physics Dept., Salt Lake City 12, Utah.	P. Gibbs G.S. Baker B.G. Dick	Al_2O_3
Westinghouse Electric Corp., Bettis Atomic Power Div., P.O. Box 1468, Pittsburgh 30, Pa.	J.M. Markowitz	UO_2
Westinghouse Research Laboratories, Beulah Road, Churchill Boro, Pittsburgh 35, Pa.	D. Hamilton A.I. Bennett H. Conrad R. Begley W. Tiller G. Shirane H.F. John	Silicon carbide from vapor phase. Silicon from melt. Copper from melt. Intermetallic compounds. Ferroelectric materials.
Westinghouse Research Laboratories, Churchill Boro., Pittsburgh 35, Pa.	E.C. Subbarao G. Shirane F. Jona	Niobates and tantalates (meta) of alkali and alkaline earths. $BaTiO_3$.

International Union of Pure and Applied Chemistry
Commission on High Temperatures and Refractories
Sub-Commission on Condensed States

LIST OF LABORATORIES IN THE UNITED STATES

active in

RESEARCH ON HIGH TEMPERATURE PHASE EQUILIBRIA

Name and Address of Institution	Personnel	Chemical Systems being Studied
Air Force Cambridge Research Center, Bedford, Mass.	J. Smiltens	Binary system Si-C
Aluminum Company of America, Alcoa Research Laboratories, P.O. Box 772, New Kensington, Pa.	P.A. Foster W.B. Frank L.M. Foster G. Long	Molten fluorides Aluminas Al-carbon
Alcoa Research Laboratories, P.O. Box 497, East St. Louis, Ill.	G.M. Bell L.D. Hart	Al_2O_3
Argonne National Laboratory, P.O. Box 299, Lemont, Illinois.	Permanent R.J. Thorn R.J. Ackermann E.G. Rauh G.H. Winslow Temporary K.D. Carlson E.D. Cater	Oxides in general; Oxides of Uranium, Thorium, Tungsten, Tantalum Hafnium, Zirconium, Molybdenum, Magnesium, Calcium. Aluminum. Sulfides of uranium.
Argonne National Laboratory, P.O. Box 299, Lemont, Illinois.	J.B. Darby, Jr. A.E. Dwight M.V. Nevitt	Binary and ternary systems of 1st, 2nd and 3rd long period elements. Binary systems of 1st, 2nd and 3rd long period elements with rare earths. Binary and ternary systems of uranium with 1st, 2nd and 3rd long period elements.

Name and Address of Institution	Personnel	Chemical Systems being Studied
Atomics International Division of North American Aviation, Inc., P.O. Box 309, Canoga Park, California.	R. Chang D.J. Klein	Zr-H U-C
Avco Corporation, 201 Lowell Street, Wilmington, Mass.	R.E. Dreikorn S. Ruby	X-ray diffraction studies of borides, nitrides, carbides, and refractory metals.
Battelle Memorial Institute, 505 King Avenue, Columbus 1, Ohio.	A. Levy H.E. Bigony H.H. Krause J.W. Droege	Hydrogen diffusion of zirconium hydrides.
	W.B. Wilson	Phase diagram and constitutional studies of inorganic refractory materials, ceramics, etc.
	A.E. Austin	X-ray patterns at elevated temperatures of UO_2, U_3O_8, and other mixed oxides.
	A.A. Bauer M.S. Farkas W. Chubb	Constitutional diagram of a number of high temperature alloys and compounds.
	M.W. Mallett A.F. Gerds	Stability of gases in refractory and reactor metals.
	W.D. Goods W.M. Albrecht	Stabilization of oxides.
	E.H. Hall J.M. Blocher, Jr.	Thermodynamic studies of halogen-halide-metal equilibria. Vapor pressure of metals and metal halides. Mass spectrometric study of high temperature equilibria involving refractory materials
Brigham Young University, Provo, Utah.	H. Tracy Hall	Carbides Borides Nitrides

Name and Address of Institution	Personnel	Chemical Systems being Studied
The Carborundum Company, Research and Development Division, Niagara Falls, New York.	P.T.B. Shaffer W.D. McKee, Jr. E. Aleshin J. Davies	Zirconium diboride-molybdenum disilicide-tantalum disilicide. Aluminum-titanium-oxygen. Aluminum-iron-oxygen. Silicon-carbon.
General Electric Company, ANPD, Evendale, Ohio.	M. Tetenbaum H.C. Brassfield R. Cooperstein P.P. Turner E. Aitken	Oxides in general Oxides of uranium
General Electric Company, Metallurgy and Ceramics Research Dept., P.O. Box 1088, Schenectady, New York.	J.H. Westbrook R.E. Carter	Ternary silicides Ferrites
Hughes Aircraft Company, Materials Research Dept., Microwave Lab., SDL, Florence and Teale Streets, Culver City, California.	M.K. Jack	Those which pertain to the synthesis of polycrystalline ferrimagnetic materials having the spinel or garnet crystal structure.
Johns Hopkins University, Applied Physics Laboratory, 8621 Georgia Avenue, Silver Springs, Md.	W. Wilson	Vapor-liquid phase diagram for $B_2O_3(l) = B_2O_3(v)$, $Al_2O_3(l) = Al_2O_3(g)$, $BN(s) = BN(v)$. Sublimation.
Lawrence Radiation Laboratory, Chemistry Division, P.O. Box 808, Livermore, California.	R.G. Bedford J.H. Carpenter D.E. Jackson J.S. Kane O.H. Krikorian R.F. Nickerson H.C. Weed Jack K.Y. Hum Lee Roberts William Ramsey Marcel Nathans James Jepsor David Wood	Transition metal and rare earth beryllides, carbides, silicides, and germanides.

Name and Address of Institution	Personnel	Chemical Systems being Studied
Massachusetts Institute of Technology, Dept. of Metallurgy, Cambridge, Mass.	M. Cohen J. Wulff N.J. Grant J. Chipman J.F. Elliott W.D. Kingery	Metallic systems Ceramic systems Metal-gas equilibria Metal-slag equilibria Solubility of gases, e.g. N_2 in Fe-Cr-Ni alloys at 1600°C, H_2O in oxide melts, Al_2O_3 in Fe at 1700°C.
M.S.A. Research Corp., Callery, Pennsylvania.	Frederick Tepper	Sn-B-Si, Pb-B-Si, Pb-Ti-C, Sn-Ti-C, Al-B-O.
National Bureau of Standards, Washington 25, D.C., Engineering Ceramics Section.	H.S. Parker S. Hasko D.J. Pastine G.F. Rynders C.H. Schreyer	Special and nuclear ceramic oxide systems
National Bureau of Standards, Washington 25, D.C., Constitution and Microstructure Section.	A. Van Valkenburg C.E. Weir	$BeO.Al_2O_3.SiO_2$ $MgO.SiO_2.F_2$
National Bureau of Standards, Washington 25, D.C., Refractories Section.	Robert S. Roth Carl Robbins Jon Waring Ernest M. Levin Sam Schneider J. Efimenko J.J. Diamond R.F. Walker	Rare earth oxides-B_2O_3 systems. Alkaline earth oxide - Nb_2O_5, Ta_2O_5 systems. Refractory oxides-GeO_2, SiO_2 systems. Rare earth oxide - rare earth oxide systems. Also, "Compilation of Phase Diagrams for Ceramists", for American Ceramic Society. Solid-gas equilibria in systems of light-metal oxides with oxygen and water.

Name and Address of Institution	Personnel	Chemical Systems being Studied
National Bureau of Standards, Washington 25, D.C., Heat Division.	D. Tsai L.M. Brown T.B. Douglas	Light metal elements, Li, Be, Mg, and Al, both free and in combination with oxygen, hydrogen, fluorine, and chlorine.
National Carbon Company, Research Laboratories, Division of Union Carbide Corporation, P.O. Box 6116, Cleveland 1, Ohio.	R.T. Dolloff R.P. Goton	Carbon, graphite, carbides, nitrides, silicides, borides.
National Lead Co., Titanium Div. Research Laboratory, P.O. Box 58, South Amboy, N.J.	K.H. Styhr	Alkali metal oxide-titanium dioxide systems.
New York College of Ceramics, Alfred University, Alfred, New York.	Daniel E. Rose	$Pb\text{-}TiO_2$, $ZnO\text{-}TiO_2$, $BaO\text{-}TiO_2\text{-}SiO_2$, $PbTiO_3\text{-}BaTiO_3$, $PbTiO_3\text{-}SrTiO_3$, $BeO\text{-}B_2O_3$, $ThO_2\text{-}B_2O_3$, $V_2O_5\text{-}SiO_2$, $MgO\text{-}Al_2O_3\text{-}SiO_2$ (Non-equilibrium phase relations).
Owens-Illinois Technical Center, Fundamental Research Section, 1700 N. Westwood Avenue, Toledo, Ohio.	S.M. Lang	$Al_2O_3\text{-}SiO_2\text{-}ZrO_2$ $Al_2O_3\text{-}SiO_2\text{-}ZrO_2\text{-}CaO$ $Al_2O_3\text{-}SiO_2\text{-}ZrO_2\text{-}CaO\text{-}TiO_2$

Name and Address of Institution	Personnel	Chemical Systems being Studied
Pennsylvania State University, College of Mineral Industries, University Park, Pennsylvania.	D. Roy C. Washaw I.Warshaw S. Aramaki H. Hoss R. Datta R. Roy F. Dachille V. Stubican D. Hawkins J. Short H. Cohen A. Muan W. Hahn J. McChesney B. Phillips R.W. Taylor E.F. Osborn F. Glasser P. Roeder O.F. Tuttle P.J. Wyllie R. Fudali P. Saha C. Spengler	MgO-MnO-NiO MgO-FeO-Fe_2O_3 FeO-Fe_2O_3-Al_2O_3-Cr_2O_3 FeO-Fe_2O_3-Cr_2O_3-SiO_2 CaO-FeO-Fe_2O_3-SiO_2 FeO-Fe_2O_3-TiO_2-SiO_2 MnO-Mn_2O_3-Al_2O_3-SiO_2 FeO-Fe_2O_3-MnO-Mn_2O_3-SiO_2 and many others.
Portland Cement Assoc. Fellowship, National Bureau of Standards, Washington 25, D.C.	F. Ordway A.J. Majumdar R.D. Thwaite	Systems containing; $3CaO.SiO_2$, $2CaO.SiO_2$ $3CaO.Al_2O_3$, and/or $2CaO.(Fe_2O_3, Al_2O_3)$
Raytheon Company, Research Division, Solid State Physics Group, Waltham, Massachusetts.	A. E. Paladino (now at M.I.T.); H.J. van Hook	Fe-Ni-O Fe-Mg-O Fe-Co-O Fe-Y-O

Name and Address of Institution	Personnel	Chemical Systems being Studied
Stanford Research Institute, Menlo Park, California.	J. Engelke E. Farley F. Halden	Carbides: TaC, HfC, VC, WC Nitrides: TiN Oxides: ThO_2-MgO-HfO_2 Mixed compounds: M-M-C, M-C-N, M-M-C-N, (M = refractory metal)
United States Steel Corp., Fundamental Research Lab., Research Center, Monroeville, Pa.	S.B. Holmquist R.P. Smith H.A. Wriedt	Silica and its binaries CaO-FeO-Fe_2O_3 Ternary Fe-C-X.
University of California, Berkeley 4, California.	A.W. Searcy L.N. Finnie	The silicide systems of the 6 Pt metals.(Only X-ray vs. composition studies are being conducted. Approximate stability data are being calculated from stabilities relative to SiC.)
University of Cincinnati, Cincinnati 21, Ohio.	Michael Hoch	Ti-Zr-O Ti-Zr-Cb-O Ti-Zr-Mo-O Ti-Zr-Ta-O Cr-Zr-O
University of Kansas, Department of Chemistry, Lawrence, Kansas.	Paul W. Gilles Ernest R. Plante Warren A. Knarr J.G.L. Wall Phillip G. Wahlbeck Stanley Killingbeck Hugo F. Franzen P. Kent Smith	Molybdenum-oxygen Tungsten-oxygen Titanium-oxygen Vanadium-oxygen Silicon-boron Rare earth-boron

Name and Address of Institution	Personnel	Chemical Systems being Studied
University of Wisconsin, Madison, Wisconsin.	J.L. Margrave V.V. Dodape (and various graduate students)	Vapor pressures of oxides, nitrides, oxygen-water-metal systems, sulfides, etc.
U.S. Bureau of Mines, Eastern Experiment Station, College Park, Maryland.	Williams J. Campbell Stephen Stecura Clark Grain	Oxides of Groups III and IV and including the rare earth series. The study also includes the effect of other oxides such as MgO, Al_2O_3, ZrO_2, and HfO_2 on rare earth oxides.
U.S. Bureau of Mines, Electrotechnical Experiment Station, P.O. Box 217, Norris, Tennessee.	Miles E. Tyrrell Norman A. Pace Haskiel R. Shell	$MgO-Al_2O_3-CaO-SiO_2$ $MgO-CaO-SiO_2$ $MgO-2SiO_2$ $MgO-MgF_2-SiO_2$ system with Li_2O, with Na_2O, or with K_2O; fluor-silicate systems.
Westinghouse Research Laboratories, Churchill Boro., Pittsburgh 35, Pa.	E.C. Subbarao	$PbO-Ta_2O_5$
Westinghouse Research Laboratories, Beulah Road, Churchill Boro., Pittsburgh 35, Pa.	R. Blaugher L. Richardson L. France P. Flynn	Tantalum-tungsten-hafnium-rhenium. Long and short range ordered systems of transition metals. Transition metal alloys.
Westinghouse Electric Corp., Bettis Atomic Power Division, P.O. Box 1468, Pittsburgh 30, Pennsylvania.	B.E. Schaner	UO_2-ZrO_2

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LIST OF LABORATORIES IN THE UNITED STATES

active in

RESEARCH IN KINETICS OF SOLID STATE REACTIONS

Name and Address of Institution	Personnel	Process or Chemical System being Studied
Atomics International, P.O. Box 309, Canoga Park, California.	S.B. Austerman	Diffusion in BeO.
Battelle Memorial Institute, 505 King Avenue, Columbus 1, Ohio.	P.D. Frost	Extrusion of refractory metals.
	A.M. Sabroff	Extrusion of Ti and Zr.
	M. W. Mallett A.F. Gerds W.D. Goode W.M. Albrecht	Kinetics of reactions, diffusion and permeation of gases in connection with refractory and reactor metals.
	W.D. Klopp C.A. Krier	Oxidation of refractory metals.
The Carborundum Company, Research and Development Division, Niagara Falls, New York.	L.D. Loch	Metal-metal oxide. Zinc oxide.
	Roy E. Dial	Formation of boron and silicon nitrides. Chlorination of B_4C, SiC, etc.
Arthur D. Little, Inc., Acorn Park, Cambridge 40, Mass.	Joan Berkowitz	Kinetics of oxidation and hydration of molybdenum and tungsten silicides to 2000°C.

Name and Address of Institution	Personnel	Process or Chemical Systems being Studied
Massachusetts Institute of Technology, Cambridge, Mass.	M. Cohen T.B. King B.L. Averbach J.F. Elliott W.D. Kingery	Nucleation and growth in precipitation from metallic solution. Diffusionless (martensitic) transformations. Reactions between liquid metallic solutions and fused salts. Diffusion in oxides.
National Bureau of Standards, Washington 25, D.C., Engineering Ceramics Section.	G.F. Rynders H.S. Parker	Oxidation, reduction, hydration reactions involving ceramic oxides, carbides, etc.
National Bureau of Standards, Washington 25, D.C., Refractories Section.	R.F. Walker J. Efimenko	Rates of vaporization and solid-gas reactions involving light-metal oxides.
National Lead Company, Titanium Division, Technical Dept., Box 58, South Amboy, N.J.	K. Styhr	Reaction rates in TiO_2 and titanates.
New York University, University Heights, New York 53, N.Y.	K.L. Komarek A. Coucoulas	Study of reaction rates between graphite and refractory oxides (ThO_2, UO_2, ZrO_2, HfO_2, TiO_2, BeO, MgO, Al_2O_3, SiO_2, CeO_2, CaO, La_2O_3, Y_2O_3, and various mixtures).

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LIST OF LABORATORIES IN THE UNITED STATES

active in

PRODUCTION OF HIGH TEMPERATURES ABOVE 1200°C

Name and Address of Institution	Personnel	Techniques Being Used
Air Force Cambridge Research Center, Bedford, Mass.	H. Fischer G.P. Ploetz	Production of extremely high temperatures (above 20000°K) by means of pulsed electrical discharges. Construction of solar and arc image furnaces, especially for growing of single crystals.
Alcoa Research Laboratories, P.O. Box 497, East St. Louis, Ill.	G.M. Bell L.D. Hart	Surface combustion.
Argonne National Laboratory, P.O. Box 299, Lemont, Illinois.	J.B. Darby, Jr. A.E. Dwight M.V. Nevitt	Resistance-heated vacuum furnaces.
Atomics International, Division of North American Aviation, Inc., P.O. Box 309, Canoga Park, California.	P.D. Johnson	Resistance heating Induction heating

Name and Address of Institution	Personnel	Techniques Being Used
Battelle Memorial Institute, 505 King Avenue, Columbus 1, Ohio.	J.G. Kura A.L. Leatherman W.H. Johnson	Cold wall induction furnace
	J.G. Kura J.W. Holliday G.W. Rengstorff E.L. Foster, Jr. W.H. Johnson	Arc furnace
	H.W. Deem G.K. Manning R.B. Fischer W.D. Wood	Mo furnace
	W.P. Allred	Electron bombardment
	J.F. Miller W.P. Allred J.W. Moody S.E. Miller J.I. Genco B. Paris	High frequency induction heating, resistance furnace.
	A.E. Weller	Production of 5000°K gas jet by chemical means.
	W. Chubb	Development of equipment to perform hot hardness measurements up to 1650°C.
	W.H. Duckworth W.G. Coppins	Carbon resistance furnace producing temperatures up to 2750°C.
	J.H. Oxley T.E. Cook	Plasma jet
Brigham Young University, Provo, Utah.	H. Tracy Hall	Electrical resistance heating of element confined at high pressures by condensed phases.
Bureau of Mines, Albany Metallurgy Research Center, Box 495, Albany, Oregon.	R.A. Beall F.W. Wood	Electron beam Arc melting Plasma jet

Name and Address of Institution	Personnel	Techniques Being Used
The Carborundum Company, Research and Development Division, Niagara Falls, N.Y.	H.D. Batha P.T.B. Shaffer J. Davies	Resistance heating Induction heating Image furnaces.
General Electric Research Laboratory, Metallurgy Department, Box 1088, Schenectady, N.Y.	P.T.S. St. Pierre C.J. Ryer	Internally-wound precious metal-heating element furnaces. Gas-fired furnaces. Molybdenum and tungsten sheet heating element furnaces. In all cases emphasis on producing simple effective devices that are expendable and require minimum ancillary equipment.
	R.M. Morlock D. Turnbull A.G. Pincus S.J. Noesen	Arc melting Electron beam heating Fuels
Lawrence Radiation Laboratory, Chemistry Division, P.O. Box 808, Livermore, California.	Arthur Neilson O.H. Krikorian	Tube furnace heated by oxy-acetylene flame.
Arthur D. Little, Inc., Acorn Park, Cambridge 40, Mass.	P.E. Glaser C. Warner F. Chellis H. Blau D.L.Richardson	Solar imaging furnace Electric arc imaging furnace Induction furnace Plasmas
Mass. Institute of Technology, Cambridge, Mass.	T.B. King W.D. Kingery J. Wulff A. Smakula	Combustion Induction Resistance Plasma jet

Name and Address of Institution	Personnel	Techniques Being Used
National Bureau of Standards, Washington 25, D.C., Engineering Ceramics Section.	Harry S. Parker J.B. Wachtman, Jr. Stephen Hasko G.F. Rynders C.H. Schreyer M.D. Burdick F.P. Knudsen L.E. Mong H. Shapiro H.J. Foster	Thoria resistor furnaces Resistance heating Induction heating Electron bombardment
National Bureau of Standards, Washington 25, D.C., Heat Division.	H.J. Kostkowski J.B. Shumaker C.R. Yokley D. Thomas L. Brown R. Thompson	High current density arcs Electrical resistance heating Shock tube Plasma generators
National Bureau of Standards, Washington 25, D.C., Refractories Section.	J.J. Diamond J. Efimenko R.S. Roth S.J. Schneider C.R. Robbins E.M. Levin R.F. Walker	Solar furnace. Arc-image furnace. Incandescent image furnace. Graphite tube furnace. R.F. and U.H.F. Induction heating. Wire-wound and sheet resistor furnaces.
National Carbon Company, Research Laboratories, Division of Union Carbide Corporation, P.O. Box 6116, Cleveland 1, Ohio.	W.W. Lozier	Arc image furnace and carbon arcs.

Name and Address of Institution	Personnel	Techniques Being Used
National Research Corp., NRC Equipment Corp., 160 Charlemont Street, Newton, Massachusetts.	Milo P. Hnilicka	Multiphase arc plasma studies. Induction high vacuum furnaces. Polyphase high-power, Na-cooled arc chamber with metallic electrodes.
	Clinton B. Sibley	Tantalum resistance high vacuum sintering furnaces -- 2500°C, working space at temp. 140 mm dia. x 230 mm. Three-phase elements of Ta or W with multiple radiation shields, within a vacuum envelope at 10^{-5} mm Hg pressure.
	Thomas M. Miller	200 KW W or Ta--3 phase resistance high vacuum furnace with a working space of 10" x 10" x 10"; work temp.--Ta element 2200°C, W element 2400°C.
National Research Corp., 70 Memorial Drive, Cambridge 42, Mass.	J.C. Simons, Jr.	Electron beam bombardment.
New York State College of Ceramics, Alfred University, Alfred, New York.	T.J. Gray	Resistance heating; Induction heating; Flames; High temperature Peltier effect.
North American Aviation, Inc., Missile Division, 12214 Lakewood Blvd., Downey, California.	W.K. Moen	Terminal resistance heating.
Owens-Illinois Technical Center, Fundamental Research Section, 1700 N. Westwood Avenue, Toledo, Ohio.	S.M. Lang	Resistance furnaces--graphite, oxides, and refractory metal; inductively heated furnaces--graphite, and refractory metals; plasma arc furnaces.

Name and Address of Institution	Personnel	Techniques Being Used
Pennsylvania State University, College of Mineral Industries, University Park, Pennsylvania.	E.F. Osborn Arnulf Muan Bert Phillips W.C. Hahn, Jr. R.W. Taylor R. Roy F. Dachille	Vertical tube quench furnaces with platinum or 80% platinum 20% rhodium resistance windings; strip furnaces with 60% platinum 40% rhodium resistors; gas-air combustion furnace; gas-air-oxygen furnace with zirconia refractories; graphite tube, arc-image, and molybdenum furnaces.
Portland Cement Assoc. Fellowship, National Bureau of Standards, Washington 25, D.C.	F. Ordway A.J. Majumdar	Vertical tube furnaces with 80 Pt-20 Rh resistance windings, for quenching, differential thermal analysis, and high-temperature centrifuge; hot-wire apparatus for high temperature microscopy and X-ray crystallography.
Radio Corp. of America, David Sarnoff Research Center, Princeton, New Jersey.	M. Kestigian	Arc image furnace
Raytheon Company, High Temperature Materials Department, Research Division, Walthan 54, Massachusetts.	E.F. Keon R.J. Russell S.F. D'Urso B. Bovarnick A. Linial	High frequency induction furnaces. High temperature graphite resistance furnaces.
Stanford Research Institute, Menlo Park, California.	N.K. Hiester R. De LaRue F.A. Halden C. Marynowski	Solar furnace Arc-image furnaces Electrical resistance furnaces Plasma-jet Induction furnaces

Name and Address of Institution	Personnel	Techniques Being Used
Sun Oil Co., Research and Development Division, P.O. Box 426, Marcus Hook, Pa.	J.L. Lauer	Shock waves in gases and electric arc techniques. Extensive work with pulsed electric arcs (hydro-magnetic shock tubes).
University of California, Dept. of Chemistry, Berkeley 4, California.	Leo Brewer Alan Searcy George Jura John Phillips	Resistance heating, High frequency induction heating, Electron bombardment, Plasmas.
University of Cincinnati, Cincinnati 21, Ohio.	Michael Hoch	Arcs, water and gas stabilized.
University of Kansas, Department of Chemistry, Lawrence, Kansas.	Paul W. Gilles Ernest R. Plante Warren A. Knarr Stanley Killingbeck J.G.L. Wall Phillip G. Wahlbeck Hugo F. Franzen P. Kent Smith	High frequency induction, Electron bombardment.
University of Wisconsin, Madison, Wisconsin.	J.L. Margrave V.V. Dodape (and various graduate students)	Induction heating, Solar mirror, High intensity electric-arc, Resistance furnaces, Flames.
U.S. Bureau of Mines, Eastern Experiment Station, College Park, Maryland.	Kenneth M. Smith Edwin E. Maust	Carbon arc image furnace. Induction furnace and various types of resistance furnaces.
U.S. Bureau of Mines, Electrotechnical Experiment Station, P.O. Box 217, Norris, Tennessee.	Perry G. Cotter Norman A. Pace	High frequency, vacuum, high amperage, carbon resistor furnaces. Resistance and arc furnaces (electric).

Name and Address of Institution	Personnel	Techniques Being Used
Westinghouse Research Laboratories, Beulah Road, Churchill Boro., Pittsburgh 35, Pa.	G. Comenetz H. Ludwig P. Flynn B. Chandrasekhar E.W. Johnson L. Richardson	Induction heating Plasma jet Electron beam Arc furnace Resistance furnace
Temple University, Research Institute, 4150 Henry Avenue, Philadelphia 44, Pa.	A.V. Grosse A.D. Kirshenbaum J.A. Cahill C.S. Stokes W. Marceau A.G. Steng W. Doyle	Furnace Rockets Chemical flames Plasma jet
United Aircraft Corp., Research Department, East Hartford 8, Conn.	J.F. Bacon R.W. Kraft	Tungsten sheet resistance furnaces. Thoria element resistance furnaces. Graphite resistor furnace with tantalum tube inserts. Induction heating. Electron bombardment. Optical imaging furnace. Refractory metals, oxides, carbides, nitrides and sulphides.

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Commission on High Temperatures and Refractories
Sub-Commission on Condensed States

LIST OF LABORATORIES IN THE UNITED STATES

active in

RESEARCH ON MEASUREMENT OF HIGH TEMPERATURES

Name and Address of Institution	Personnel	Remarks
Argonne National Laboratory, P.O. Box 299, Lemont, Illinois.	R.J. Thorn G.H. Winslow R.J. Ackermann	Temperature scale above 1000°C.
Battelle Memorial Institute, 505 King Avenue, Columbus 1, Ohio.	H.W. Deem W.D. Wood O.L. Linebrink	Spectral and total hemispherical emissivities of Mo, Ta, and other metallic systems. Primary and reference standards of temperature measurement by thermocouple, optical, two color and radiation pyrometry.
The Carborundum Company, Research and Development Division, Niagara Falls, New York.	R. Emanuelsen	
General Electric Company, Metallurgy and Ceramics Research Department, P.O. Box 1088, Schenectady, N.Y.	W.F. Moore S.J. Noesen	
Lawrence Radiation Laboratory, Chemistry Division, P.O. Box 808, Livermore, California.	O.H. Krikorian	

Name and Address of Institution	Personnel	Remarks
Arthur D. Little, Inc., Acorn Park, Cambridge 40, Mass.	H. Blau D. Comstock A. Emslie P.E. Glaser	Measuring emissivities ceramics, metals, semi-conductors.
Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge 39, Mass.	Alexander Smakula N.J. Grant	
National Carbon Company, Research Laboratories, Division of Union Carbide Corporation, P.O. Box 6116, Cleveland 1, Ohio.	W.W. Lozier B.H. Eckstein	Emissivities are measured from time to time on forms of carbon and graphite, various special refractories such as carbides, nitrides, etc.
National Research Corp., NRC Equipment Corp., 160 Charlemont Street, Newton, Massachusetts.	Milo P. Hnilicka C.B. Sibley M. Miller	
New York College of Ceramics, Alfred University, Alfred, New York.	T.J. Gray and Associates	Thermal diffusivities; electron and ion emission, with and without applied radiation; semiconductor thermoelectric effect.
Owens-Illinois Technical Center, Fundamental Research Section, 1700 N. Westwood Avenue, Toledo, Ohio.	S.M. Lang	Temperature range 3000° to 30,000° Kelvin.
The Pennsylvania State University, College of Mineral Industries, University Park, Pennsylvania.	E.F. Osborn Arnulf Muan Bert Phillips W.C. Hahn, Jr. R.W. Taylor	

Name and Address of Institution	Personnel	Remarks
Stanford Research Institute, Menlo Park, California.	J. Engelke	
United Aircraft Corp., Research Department, East Hartford 8, Conn.	R.W. Kraft R. Erf	Refractory metals by photocell and pyrometer techniques in optical imaging furnace.
University of California, Department of Chemistry, Berkeley 4, California.	Leo Brewer Alan Searcy George Jura	
University of Kansas, Department of Chemistry, Lawrence, Kansas.	Paul W. Gilles Ernest R. Plante	
University of Wisconsin, Madison, Wisconsin.	J.L. Margrave V.V. Dodape (and graduate students)	Measuring emissivities of C, W, various oxides including Cr_2O_3, Al_2O_3, and UO_2.
Westinghouse Research Laboratories, Beulah Road, Churchill Boro., Pittsburgh 35, Pa.	G. Comenetz	Measuring emissivities of metallic systems.

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Sub-Commission on Condensed States

LIST OF LABORATORIES IN THE UNITED STATES

active in

RESEARCH ON PHYSICAL PROPERTIES OF CONDENSED PHASES
STABLE ABOVE 1000 °C

Name and Address of Institution	Personnel	Property	Chemical Systems
Atomics International, Division of North American Aviation, Inc., P.O. Box 309, Canoga Park, California.	S.B. Austerman R. Chang P.D. Johnson J. King, Jr. D.J. Klein J.D.McClelland B.D. Pollock J.A. Rubin R.E. Taylor	Sintering and hot pressing kinetics, specific heats, thermal conductivity and expansion. Mechanical properties (modulus of rupture and creep). Grain growth kinetics in polycrystalline systems. Diffusion, anelastic phenomena, vaporization, gas-solid interaction (including kinetics).	Be-O-MgO BeO-Al_2O_3 BeO-UO_2 BeO-UO_2-MgO MgO-UO_2 BeO UO_2

Name and Address of Institution	Personnel	Property	Chemical Systems
Battelle Memorial Institute,	A.E. Austin	Seebeck coefficient and electrical resistivity.	Various oxides.
505 King Avenue,	C.M. Schwartz	Polymorphism and	Various
Columbus 1, Ohio.	A.E. Austin	thermal expansion.	oxides.
	W.F. Simmons	Creep strength, stress	Heat resist-
	J.A. VanEcho	rupture and tensile	ance and
	J.E. Campbell	strength.	refractory
	D.P. Moon		metals from
	L.D. Rice		subzero to
	F. Shober		1550°C.
	R.L. Carlson	Mechanical properties.	Metals and
	D.H. Fisher		ceramics in the 1000-3000°C temperature range
	H.W. Deem	Linear expansion and specific heat	High melting metals and oxides.
	J.W. Droege	Heat of formation.	SiC.
	C. Hyde	Evaluation of ablation	Ceramics.
	J.M. Allen	properties.	
	R.B. Fischer	Hardness and mechanical strength.	Metal carbides, ultra high pressure - temp. reactions.
	W.H. Duckworth	Mechanical and	Carbides,
	W.G. Coppins	electrical.	borides, silicides and oxides.
	W.M. Albrecht	Melting point deter-	Metals and
	A.F. Gerds	minations.	alloys.
	M.W. Mallett		
	W.D. Goode		
	W.H. Safranek	Mechanical and	Coatings.
	C.L. Faust	physical.	Electrode position at high temp.

Name and Address of Institution	Personnel	Property	Chemical Systems
Bausch and Lomb Optical Co., 635 St. Paul St., Rochester, N.Y.	N. Kreidl H. Hafner D. Buckner E. Letter		MgF_2 and other fluorides hot pressed at very high pressures.
Carborundum Company, Research and Development Division, Niagara Falls, N.Y.	A.H. Falter T. Brajkovich C.E. Shulze K.M. Taylor W.A.Lambertson	Thermal conductivity Thermal expansion Thermal shock Modulus of elasticity Melting points Viscosities Corrosion rates	Oxides Carbides Nitrides Borides Silicides
General Electric Co., ANPD, Evendale, Ohio.	M. Tetenbaum H.C.Brassfield P.P. Turner E. Aitken	Vapor pressures. Thermodynamic properties.	Uranium oxides. Refractory oxides.
General Electric Co., Research Laboratory, Schenectady, N.Y.	J.H. Westbrook M.L. Kronberg S.P. Mitoff	Mechanical Electrical	MgO Intermetallics NiO Al_2O_3 NaCl structure oxides.
International Business Machines, Research Laboratory, Boardman Road, Box 390, Poughkeepsie, N.Y.	M.W. Shafer E.A. Giess J.M. Brownlow V.L. Moruzzi		Ni-Fe-O Mn-Fe-O Rare earth-iron oxide systems.
Lawrence Radiation Laboratory, Chemistry Division, P.O. Box 808, Livermore, California.	Jack K.Y. Hum Lee Roberts		

Name and Address of Institution	Personnel	Property	Chemical Systems
Arthur D. Little, Inc., Acorn Park, Cambridge 40, Mass.	H. Blau A. Emslie P.E. Glaser	Emissivity, thermal conductivity.	Semiconductors, ceramics, metals
Massachusetts Inst. of Technology, Dept. of Metallurgy, Cambridge, Mass.	M. Cohen J. Wulff N.J. Grant B.L. Averbach M.B. Bever J. Chipman J.F. Elliott T.B. King W.D. Kingery F.H. Norton J.T. Norton A. Smakula	Crystal structure. Phase transformations. Order-disorder. Thermodynamics of solutions-solid and liquid metals. Thermodynamics of intermetallic compounds Solidification. Magnetic properties. Creep surface tension. Thermal conductivity.	Numerous metallic and ceramic (oxide) systems.
National Bureau of Standards, Washington 25, D.C., Constitution and Microstructure Section.	A. Van Valkenburg C.E. Weir F.A. Mauer	Thermal stabilities and phase relationships. Polymorphism and thermal expansion by X-ray methods.	BeO, Al_2O_3 SiO_2 $MgO.SiO_2.F_2$ High melting carbides and oxides.
National Bureau of Standards, Washington 25, D.C., Engineering Ceramics Section.	M.D. Burdick J.B. Wachtman, Jr. F.P. Knudsen H.S. Parker S. Hasko S. Spinner L.E. Mong W.E. Tefft D.G. Lam, Jr.	Strength properties Thermal expansion Elastic properties	Oxide and cermet systems.

Name and Address of Institution	Personnel	Property	Chemical Systems
National Bureau of Standards, Washington 25, D.C., Heat Division.	R.E. Ferguson K.E.McCulloh John D. McKinley Tucker Carrington Milton D. Scheer E.D. West D.C. Ginnings T.B. Douglas	Energy levels of OH Radicals in flames Enthalpy Thermal diffusivity Heat capacity	High temperature reactions of hydrocarbons. Hydrocarbon oxidation. Metals and halogen beams. Reaction of alkali halide beams. Pure substances. Compounds of light elements.
National Bureau of Standards, Washington 25, D.C., Refractories Section.	R.F. Walker J. Efimenko J.J. Diamond	Vapor pressures Melting points Phase transformations	Light-metal oxides, SiO_2
National Carbon Company, Research Laboratories, P.O. Box 6116, Cleveland 1, Ohio.	S. Senderoff L.M. Litz R.T. Dolloff W.P. Eatherly J. Pike	Conductivity (thermal and electrical) Density Optical properties Mechanical properties	Fused salts. Carbon and carbides. Super-refractories (nitrides, silicides, borides, sulfides)
National Lead Co., Titanium Division, Technical Dept., Box 58, South Amboy, N.J.	K. Styhr	Crystalline phase changes	TiO_2 and titanates.

Name and Address of Institution	Personnel	Property	Chemical Systems
New York College of Ceramics, Alfred University, Alfred, New York.	T.J. Gray / C.E. Myers	Semiconductivity and related phenomena Thermal emf Diffusivity Mechanical properties Vaporization	Alumina and other oxides. Sulfides. Selenides and tellurides in single crystal, hot pressed and sintered forms. Transition metal and boron phosphides.
	W.B. Crandall S. Smith D. Chung J.P. Tinklepaugh J. Swica R. Truesdale J. Connors	Unsteady state heat transfer Flexual strength Modulus of elasticity Thermal conductivity	Al_2O_3 plus minor impurities; single and polycrystalline. Metal fibre-ceramic bodies. Fine grained Al_2O_3 bodies below 5μ grain size.
Owens-Illinois Technical Center, Fundamental Research Section, 1700 N. Westwood Ave., Toledo, Ohio.	S.M. Lang		
Portland Cement Assoc. Fellowship, National Bureau of Standards, Washington 25, D.C.	F. Ordway D.K. Smith	Phase relationships Polymorphism Crystal structure	Systems containing $3CaO.SiO_2$, $2CaO.SiO_2$, $3CaO.Al_2O_3$, and/or $2CaO.(Fe_2O_3, Al_2O_3)$

Name and Address of Institution	Personnel	Property	Chemical Systems
Radio Corp. of America, David Sarnoff Research Center, Princeton, N.J.	M. Kestigian		Operation of a Verneuil type furnace.
Raytheon Company, High Temperature Materials Dept., Research Division, Waltham, Mass.	E.F. Keon R.J. Russel S.F. D'Urso B. Bovarnick A. Linial	Thermal conductivity Specific heat Strength Thermal expansion Emissivity	
Stanford Research Institute, Menlo Park, California.	F.A. Halden J.L. Engelke E. Farley	Thermal expansion Melting point Stability in air at elevated temperatures	Uranium dioxide. TaC, HfC, VC, WC, TiN, ThO_2-MgO-HfO_2 M-M-C, M-C-N, M-M-C-N (M = refractory metal
	J.W. Johnson	Thermoelectric power Thermal conductivity Electrical conductivity	Cuprous sulfide, chalcopyrite and similar semiconducting systems.
Temple University, Research Institute, 4150 Henry Ave., Philadelphia 44, Pa.	A.V. Grosse A.D. Kirshenbaum J.A. Cahill	Density, Surface tension, Viscosity.	Alkaline earth fluorides including magnesium fluoride (Group II A). Rare earth fluorides. Aluminum oxide, silicon dioxide.
United Aircraft Corp., Research Dept., East Hartford 8, Conn.	J.F. Bacon R.W. Kraft	Vapor pressure and viscosity, thermal and electrical conductivity, specific heat, surface tension; linear expansion, some mechanical properties.	Refractories and refractory metals.

Name and Address of Institution	Personnel	Property	Chemical Systems
University of Cincinnati, Cincinnati 21, Ohio.	Michael Hoch	Specific heat Thermal conductivity	Ta, Mo, Cb, and their alloys.
University of Kansas, Dept. of Chemistry, Lawrence, Kansas.	Paul W. Gilles Ernest R. Plante Warren A. Knarr Stanley Killingbeck J.G.L. Wall Phillip G. Wahlbeck Hugo F. Franzen P. Kent Smith	Vapor pressures Thermodynamic properties.	Molybdenum - oxygen Tungsten-oxygen Titanium-oxygen Vanadium-oxygen Silicon-boron Rare earth - boron
University of Utah, Physics Department, Salt Lake City 12, Utah.	P. Gibbs G.S. Baker B.G. Dick A.M. Feingold	Optical photoconductivity, internal friction, ion emission, dielectric loss, creep, crystal growth, surface structures, metal interface.	Al_2O_3
University of Wisconsin, Madison, Wisconsin.	J.L. Margrave V.V. Dodape (and various graduate students)	Surface tension Density Heats of fusion Vapor pressures Heat capacities	Oxides Nitrides Borides Carbides Sulfides Hydroxides
U.S. Bureau of Mines, Eastern Experiment Station, College Park, Md.	Herbert H. Greger Louis P. Domingues Roy Wilfong	Elastic moduli Thermal conductivity Thermal expansion Thermal effects by differential thermal analysis.	Oxides of Groups III and IV, including the rare earth series. Also, their combination with other oxides such as BeO, CaO and MgO.

Name and Address of Institution	Personnel	Property	Chemical Systems
U.S. Bureau of Mines, Electrotechnical Experiment Station, P.O. Box 217, Norris, Tennessee.	Perry G. Cotter Gilbert Farrior Miles E. Tyrrell Norman A. Pace Phillip Pigott Howard P. Hamlin Donald Bloss Gerald V. Gibbs John Miller Haskiel R. Shell	Chemical stability; Oxidation resistance; Thermal expansion; Strength per se and under load; Fatigue; Corrosion; Bloating in shales, clays, etc., for lightweight aggregate; Thermal expansion (X-ray diffraction); Polymorphic changes (by DTA and X-ray); Melting points of fluormicas; Composition of silicate liquids near the melting point.	Carbides, nitrides, borides, silicides, single and multiple oxides systems in groups II, III, IV. Natural mineral or rock silicate systems. Oxides and silicate and fluorsilicate systems, both natural and synthetic.
U.S. Bureau of Mines, Mineral and Thermodynamics Experiment Station, 226 Hearst Mining Bldg., Berkeley 4, California.	Kenneth K. Kelley Edward G. King	Heat contents above 25°C.	Oxides, interoxidic compounds, halides, silicates.
Westinghouse Research Laboratories, Beulah Rd., Churchill Boro., Pittsburgh 35, Pa.	R.C. Miller R.R. Heikes E.V. Somers P.E. Blackburn E.A. Gulbransen J. Weissbart L. Richardson R. Begley L. France E. Wessel F.C. Hull C.S. Williams	Seebeck coefficient Electrical resistivity Thermal conductivity Oxidation rates Vapor pressure Oxide ion conduction Tensile strength Creep strength Hardness	Perovskites Rare earth chalcogenides Zirconium oxide Tungsten Niobium Tantalum Molybdenum Alloys

PART III

LIST OF LABORATORIES IN SCANDINAVIAN COUNTRIES

active in

RESEARCH ON CONDENSED STATES

AT

HIGH TEMPERATURES

This information has been supplied by:

Professor Gunnar Hagg,
University of Uppsala,
Uppsala,
Sweden.

International Union of Pure and Applied Chemistry
Commission on High Temperatures and Refractories
Sub-Commission on Condensed States

LIST OF LABORATORIES IN SCANDINAVIAN COUNTRIES

active in

RESEARCH ON CONDENSED STATES AT HIGH TEMPERATURES

Where possible the special field of interest has been given according to the following system, adopted by the Commission on High Temperature (Sub-Commission on Condensed States) of IUPAC in their Bibliographies:

A. Devices for achieving high temperatures.

B. Devices for measuring and controlling high temperatures.

C. Devices for physical measurements at high temperatures.

D. Properties of refractory phases and systems studied at lower temperatures.

   a. Metallic systems

   b. Non-metallic systems

   c. Mixed systems

E. Properties and uses of refractory phases and systems at high temperatures.

   a. Metallic systems

   b. Non-metallic systems

   c. Mixed systems

F. Properties of non-refractory phases and systems at high temperatures.

a. Metallic systems

b. Non-metallic systems

G. Phase equilibria

H. Reactions (physical and chemical) at high temperatures.

1. - NORWAY - Research Institutes

Institutt for Silikatforskning (Institute for Silicate Research)* and Institutt for Uorganisk Kjemi (Institute of Inorganic Chemistry), Norges Tekniske Hogskole (Technical University of Norway), Trondheim.

Håkon Flood, Dr.ing., professor	Eb, Fb, G, H
Tormod Forland, dr.techn.	C, Eb, Fb, G, H
Kai Grjotheim, dr.techn., dosent	Db, Eb, Ec, Fa, Fb, G, H
Egil Aukrust, siv.ing.	Eb, Fb, G
Jorulf Brynestad, siv.ing.	Eb, Fb, G
Katrine Seip Forland, siv.ing.	Eb, Fb, G
Ketil Motzfeldt, siv.ing.	A, B, C, Eb, G, H
Anders Schei, siv.ing.	Eb, Fb, G
Peder Svendsås, siv.ing.	Eb, G, H
Sigmund Urnes, siv.ing.	Db, Eb, Fb, G

Metallurgisk Institutt (Institute of Metallurgy), Norges Tekniske Hogskole (Technical University of Norway), Trondheim.

Terkel Rosenqvist, professor	F, G
Sigmund Bog, cand.real.	
Lars Rossemyr, siv.ing.	

*Norges Teknisk-Naturvitenskapelige Forskningsråd (The Technical and Natural Science Research Council of Norway).

Metallurgisk Komite (Metallurgical Committee)*, N.T.H., Trondheim.

Arne Hoy, siv.ing.	D, E, F, H
Sverre Slevolden, siv.ing.	H

Sentralinstitutt for Industriell forskning (Central Institute for Industrial Research)*, Forskningsvn. 1, Blindern.

Hallstein Kjollesdal, siv.ing.	Da, Ea, H
Tor Hurlen, cand.real.	
Per Kofstad, dr.phil.	
Nico Norman, dr.phil.	

II. - SWEDEN - Research Institutes

Institutet for Halvledarforskning (Institute for Semiconductor Research), Regeringsgatan 109, Stockholm Va.

Dick Lundqvist, fil.lic.
Hans Nettelbladt, tekn.lic.
Per Svedberg, civ.ing.

Kungl. Tekniska Hogskolan (Royal Technical University), Stockholm 70.

Institutionen for Hållfasthetslara (Institute of Strength of Materials).

Folke K.G. Odqvist, professor	A, B, C, Da
Jan Hult, docent	
Ragnar Lundell, civ.ing.	
Arne Mellgren, teknolog	

Institutionen for Jarnets Bearbetning och Behandling (Institute of the Treatment of Iron and Steel).

Gunnar Wallquist, professor

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*Norges Teknisk-Naturvitenskapelige Forskningsråd (The Technical and Natural Science Research Council of Norway).

Institutionen for Jarnets Metallurgi (Institute of Iron and Steel Metallurgy).

Martin Wiberg, professor
J.O. Edstrom, docent
Erik Sjostrand, bergsing.

Institutionen for Metallhyttkonst (Institute of Metallurgy).

Gotthard Bjorling, professor H

Institutionen for Teknisk Oorganisk Kemi (Institute of Technical Inorganic Chemistry).

Sten Tore Lundin, tekn.lic. Db, H

Metallografiska Institutet (Swedish Institute for Metal Research), Drottning Kristinas Vag 48, Stockholm O.

Erik Rudberg, professor Da, Dc, Ec
C. Georg Carlsson, bergsing
Helmuth Fischmeister, Dr.Phil. D, E, H
Tore Malmberg, fil.kand.
Holger Pettersson, bergsing.

Stockholms Hogskola (University of Stockholm)

Institutionen for Oorganisk och Fysikalisk Kemi (Institute of Inorganic and Physical Chemistry), Kungstensgatan 45, Stockholm Va.

Arne Magneli, laborator D, E, G
Sten Andersson, forskningassistent
Stig Åsbrink, fil.kand.
Bo Holmberg, fil.kand.
Bengt-Olof Marinder, fil.kand.
Claes Nordmark, fil.kand.
Sven Westman, fil.kand.

Svenska Silikaforskningsinstitutet (Swedish Institute for Silicate Research). Chalmers Tekniska Hogskola (Chalmers Technical University, Gibraltargatan 5 J, Goteborg S.

Cyrill Brosset, professor
F. Sandford, docent

Uppsala Universitet (University of Uppsala)

Kemiska Institutionen (Institute of Chemistry) Uppsala

Gunnar Hagg, professor	
Bertil Aronsson, fil. lic.	Da, Ea, G
Jan Åselius, fil.kand.	Da, Ea, G
Lars Kihlborg, fil.mag.	Db, G, H
Gunvor Lundgren, fil.mag.	Da, Ea, G
Torsten Lundstrom, fil.mag.	Da, Ea, G
Stig Rundqvist, fil.mag.	Da, Ea, G

Industrial Laboratories

Allmanna Svenska Elektriska Aktiebolaget (ASEA), Vasterås (Ludvika, Stockholm).

J. Blaus	A, B, Db, Eb, Fb, H
K. Hellbom	A, B, C, Da, (Dc), Ea (Ec), Fa, G, H
L. Halle	H
R. Svensson (Ludvika)	H
E. Lundblad (Stockholm)	A, B, C, G, H

Aktiebolaget Atomenergi, Lovholmsvagen 7, Stockholm 9.

Roland Kiessling, docent	A - E, G, H
Jan Flinta, civ.ing.	C, Eb

Avesta Jernverks Aktiebolag, Avesta.

Johannes Baecklund, fil.lic.
Stig Berg, ing.
Sten von Matern, bergsing.

Bolidens Gruvaktiebolag, Skelleftehamn.

Sven Wallden, forskningschef
K.G. Gorling, ing.
Sven Lundquist, Dr-Ing.

Aktiebolaget Hoganasmetoder, Hoganas.

L. Berg, ing.	E, H
K. Bjorklund, civ.ing.	
G. Bockstiegel, dr.	
S. Johansson, civ.ing.	
K. Leander, 1:e ing.	

Aktiebolaget Kanthal, Hallstahammar.

Per Bjorkman, bergsing.	A, B, E

Aktiebolaget Max Sievert, Stockholm-Bromma.

Alf Fluur, civ.ing.	B
N.T. Nilsson, overing.	A

Svenska Flygmotor Aktiebolaget, Trollhattan.

Gillis Huss, tekn.lic.	B, C, E

Aktiebolaget Svenska Metallverken, Vasterås.

Bengt-Olof Rosell, civ.ing.	Ec
Orjan Wiberg, bergsing.	

Svenska Metallverkens Ugns Aktiebolag, Vasterås 10.

P.O. Strandell, bergsing.	A, B

Uddeholms Aktiebolag, Hagfors Jernverk, Laboratoriet, Hagfors.

Klas Erik Johansson, bergsing.	
Georg Engstrand, tekn.lic.	
Olle Lindberg, civ.ing.	
Bertil Rydstad, bergsing.	

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