ERDA 55

MATERIALS SCIENCES PROGRAMS

FY 1975

UNITED STATES
ENERGY RESEARCH & DEVELOPMENT ADMINISTRATION
DIVISION OF PHYSICAL RESEARCH

ERDA 55
UC-25

M A T E R I A L S

S C I E N C E S

P R O G R A M S

F Y 1 9 7 5

July 1975

UNITED STATES ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

DIVISION OF PHYSICAL RESEARCH

FOREWORD

During FY 1975, the Atomic Energy Commission was abolished and its Physical Research Division was totally absorbed into the Energy Research and Development Administration. Six activities were created under the ERDA Administrator, each headed by an Assistant Administrator: National Security, Fossil Energy, Nuclear Energy, Conservation, Environment and Safety, and Solar, Geothermal, and Advanced Energy Systems. While organizationally the Division of Physical Research is located under the Assistant Administrator for Solar, Geothermal and Advanced Energy Systems, the mission of the Division is to provide the physical research base for all ERDA activities.

The Materials Sciences Subprogram constitutes one portion of a wide range of research supported by the ERDA Division of Physical Research. Other programs are administered by the Division's Nuclear Sciences, Molecular Sciences, and High Energy Physics Offices. Materials Sciences research is supported primarily at ERDA National Laboratories and Universities. The research covers a spectrum of scientific and engineering areas of interest to the Energy Research and Development Administration and is conducted generally by personnel trained in the disciplines of Solid State Physics, Metallurgy, Ceramics, and Chemistry.

This report contains a listing of all research underway in FY 1975 together with a convenient index to the program.

Donald K. Stevens
Assistant Director
(for Materials Sciences Program)
Division of Physical Research

INTRODUCTION

The purpose of this report is to provide a convenient compilation and index of the ERDA's Materials Sciences Program. This compilation is intended for use by administrators, managers, and scientists to help coordinate research and as an aid in selecting new programs.

The report is divided into Sections A and B, listing all the projects, Section C, a summary of funding levels, and Section D, an index.

Each project carries a number (underlined) for reference purposes. The FY 1975 funding level, title, personnel, budget activity number (e.g. 01-02), and key words and phrases accompany the project number. The first two digits of the budget number refer to either Metallurgy and Ceramics (01), Solid State Physics (02), or Materials Chemistry (03). The budget numbers carry the following titles:

01-01 - Structure of Materials
01-02 - Mechanical Properties
01-03 - Physical Properties
01-04 - Radiation Effects

02-01 - Neutron Scattering
02-02 - Experimental Research
02-03 - Theoretical Research
02-04 - Particle-Solid Interactions

03-01 - Chemical Structure
03-02 - Engineering Chemistry
03-03 - High Temperature and Surface Chemistry

Section C summarizes the total funding level in a number of selected categories. Obviously most projects can be classified under more than one category and, therefore, it should be remembered that the categories are not mutually exclusive.

In Section D the references are to the project numbers appearing in Sections A and B and are grouped by (1) investigators, (2) materials, (3) technique, (4) phenomena, and (5) environment.

It should be recognized that it is impossible to include in this report all the technical data available for such a large program. By the time it could be compiled it would be outdated. The approach taken here was to summarize each project with key words and phrases reflecting the activity under the project. The best method for obtaining more detailed information about a given research project is to contact directly the investigators listed.

Louis C. Ianniello
Materials Sciences Program
Division of Physical Research

TABLE OF CONTENTS

SECTION A - Laboratories

SECTION B - Universities

SECTION C - Funding Levels

SECTION D - Index

SECTION A

Laboratories

The information was taken from current Laboratory program budget submissions. Most projects are of a continuing nature although specific problems and some projects were concluded in FY 1975.

AMES LABORATORY
Iowa State University
Ames, Iowa 50010
Phone: Area Code 515 284-4000

Metallurgy and Ceramics -01-
K. A. Gschneidner, Jr. - Phone: 294-2272

1. STRUCTURE OF MATERIALS $215,000 01-01
O. N. Carlson, F. A. Schmidt
R. K. Trivedi

Basic research involving the interaction of interstitial solutes, primarily O, H, N, and C, with bcc metals (especially the transition metals of groups III, IV, V and VI) as well as thorium, uranium and iron; development of processes of ultrapurification of metals; study of transport phenomena including electrotransport, thermotransport, and mass transport due to concentration gradients; theoretical and experimental studies (LEED and Auger spectroscopy) involving free and bounded metal, surfaces, phase formation kinetics and morophologies of precipitates; investigations of the effects of solutes on mechanical properties especially the temperature dependence of the flow stress of bcc metals; development of methods for preparing high temperature composite materials by controlled solidification; reprocessing of metal scrap by ESR and other techniques; study of the mechanical properties and corrosion resistance of ferritic alloys.

2. MECHANICAL PROPERTIES $320,000 01-02
T. E. Scott, O. Hunter,
R. A. Jacobson, D. T. Peterson

Fundamental studies of strengthening mechanisms of metals and ceramics and of the factors in various environments which result in the degradation of mechanical properties; studies are primarily concerned with the refractory metals and oxides of yttrium, europium, hafnium, zirconium and tantalum; investigation of the effects of hydrogen and its isotopes on the properties of refractory metals especially candidate materials for the CTR first wall; development of fabrication techniques for MHD materials.

AMES LABORATORY
Metallurgy and Ceramics -01- (Continued)

3. PHYSICAL PROPERTIES $655,000 01-03
J. F. Smith, D. M. Bailey,
M. F. Berard, C. W. Chen,
P. Chiotti, K. A. Gschneidner, Jr.,
F. X. Kayser, O. D. McMasters,
J. W. Patterson, J. D. Verhoeven,
D. R. Wilder, D. E. Williams

Studies concerning the relationships between structures (electronic, atomic, and microstructures) and the physical properties of metals, alloys, ceramics and composites; experimental areas and techniques employed include magnetic investigations, low temperature calorimetry, x-ray diffraction, scanning and transmission electron microscopy, basic thermodynamic studies, elastic constant determinations, electron microprobe analyses, and diffusion studies; the major categories of materials being investigated are rare earth metals and their alloys, the refractory metals, cerium and its allotropes, Pt-transition metal systems, thorium, uranium (and thorium and uranium compounds), eutectic alloys, Fe-Si and Fe-Al alloys, superconducting materials (for example, Nb-Zr alloys, $LaOs_2$, and La_3In as well as other alloys based on these metals), lithium compounds, ceramic oxides and oxide systems including HfO_2-Eu_2O_3, HfO_2 - and Ta_2O_5 - rare earth oxide mixtures, mixed oxide electrolytes, and SrF_2-BaF_2. CaF_2-YF_3, CaF_2-SrF_2 and other fluoride systems; new work is planned on the production of hydrogen or methane from coal using fused salt reactions.

4. RADIATION EFFECTS $285,000 01-04
M. S. Wechsler, C. W. Chen

Investigations on fundamental changes in physical and mechanical properties of metals and alloys caused by radiation; void formation and resultant dimensional changes; influence of impurities on radiation-produced defect clusters, radiation hardening, and radiation embrittlement; irradiations carried out chiefly in the Ames Laboratory Research Reactor using the flux converter and the reactor cryostat; mechanical tests, transmission electron microscopy, and electrical resistivity studies; theoretical analyses; materials include refractory metals, thorium, Ni-C, and Ni-Al alloys; major future thrusts: further development and testing of dynamic trapping mechanism discovered in the Ni-C alloys to reduce void formation and therefore increase the dimensional stability of irradiated metals and alloys, and further investigation of the influence of impurities and alloying additions on radiation-induced changes in mechanical properties, with a view toward providing the basis for developing alloys whose mechanical properties will be less severely affected by radiation exposure.

AMES LABORATORY
Solid State Physics Division -02-
K. L. Kliewer - Phone: 294-4037

5. NEUTRON SCATTERING $495,000 02-01
S. K. Sinha, C. Stassis,
J. G. Traylor, G. R. Kline

Neutron scattering and phonon dispersion relations for the alkali-tungsten-bronze system, Nb-based alloys and rare-earth trifluorides; electron-phonon interaction and soft modes as related to superconductivity; structural and dynamical studies of transition metal-hydride systems and Th-hydrides; inelastic neutron scattering studies of dynamics of molecular crystals and charge transfer salts; short-range order of water molecules in electrolyte solutions; magnetic structure determinations of rare-earth metals and alloys; electronic distributions in rare-earth metals and the actinides.

6. MAGNETIC PROPERTIES OF SOLIDS $ 74,300 02-02
S. Legvold, J. L. Stanford,
R. W. Green

Electronic properties of metals and alloys as they relate to magnetic manifestations; experimental studies of band structures, generalized susceptibilities and Fermi surfaces of transition metals and alloys; valence and phase changes in metals and alloys; Kondo effect in transition metal alloys.

7. NUCLEAR RESONANCE IN SOLIDS $150,800 02-02
R. G. Barnes, D. R. Torgeson

Nuclear hyperfine interactions in solids, NMR, NQR, NGR: deuteron and transition metal NMR to characterize lattice sites and to study structural phase transformations and self-diffusion in transition metal hydride and deuteride phases, and to characterize lattice perfection and structural transformations in superconducting intermetallic compounds.

AMES LABORATORY
Solid State Physics Division -02- (Continued)

8. SUPERCONDUCTIVITY $226,400 02-02
G. C. Danielson, D. K. Finnemore,
A. J. Bevolo, H. R. Shanks,
J. E. Ostenson

Electron tunneling and thermal conductivity in laminar (two-dimensional) superconductors; spin-scattering rates for the Kondo effect and for superconductivity in quench-condensed films; microwave surface impedance studies of vortex nucleation; effects on specific heat and magnetization of attractive interactions between quantized vortices; superconducting transition temperatures near soft-mode crystal structure phase boundaries; Einstein mode specific heat contributions in superconducting non-stoichiometric tungsten bronzes.

9. THERMODYNAMIC AND TRANSPORT PROPERTIES OF SOLIDS $263,900 02-02
G. C. Danielson, C. A. Swenson,
G. L. Salinger, A. J. Bevolo,
M. S. Anderson, H. R. Shanks,
P. H. Sidles, D. R. Schouten

Heat capacity measurements at low temperatures of PbTe, SnTe, GeTe, $NbSe_2$, tungsten bronzes, and apiezon-N grease; capacitance dilatometer thermal expansion measurements on copper, aluminum, rare-earth single crystals, and amorphous systems; high pressure studies of solidified hydrogen isotopes, transport properties (thermal conductivity, electrical conductivity, Seebeck coefficient) of iron, vanadium, the group IV tellurides, and amorphous semiconductors; switching properties of Te-As-Ge glasses and melanin; crystal growth and purification of NbS_2, $NbSe_2$, TaS_2, MoS_2, the tungsten bronzes, and rare-earth chalcogenides; studies of surfaces and thin films with applications for solar cells and fuel cells.

10. OPTICAL AND SPECTROSCOPIC PROPERTIES OF SOLIDS AND LIQUIDS $155,500 02-02
D. W. Lynch, C. G. Olson,
F. H. Spedding, M. Piacentini,
A. Habenschuss

Optical properties (transmission, reflection, thermoreflection, electroreflection) of solids in the near infrared, visible, and vacuum ultraviolet (using synchrotron radiation): transition metals and alloys, noble metals, IV and IV-V semiconductors, rare earths, rare-earths trifluorides, LaB_6; photoemission into liquids; Raman scattering and x-ray diffraction in aqueous solutions: HDO, D_2O, rare-earth chlorides, and perchlorates.

AMES LABORATORY
Solid State Physics Division -02- (Continued)

11. RARE EARTH METALS PREPARATION — $119,100 — 02-02
K. A. Gschneidner, Jr.,
B. J. Beaudry, P. E. Palmer

Preparation of kilogram quantities of highly pure rare-earth metals; preparation of single crystals of rare-earth fluorides, metals and special alloys; study new methods for preparation of highly pure rare-earth metals in kilogram quantities.

12. OPTICAL AND SURFACE PHYSICS THEORY — $ 80,300 — 02-03
R. Fuchs, K.L. Kliewer,
P. R. Rimbey, D. L. Johnson

Optical properties of metals and insulators; studies of surfaces, thin films, and small particles; nonlocal effects in optical properties and photoemission; effects of surface roughness; collective excitations: phonons, plasmons, and excitons, photoemission into liquid electrolytes; Compton and Raman scattering.

13. SUPERCONDUCTIVITY THEORY — $ 22,500 — 02-03
J. R. Clem

Theory of magnetic structures and magnetic coupling in superconductors; theory of energy dissipation due to flux motion; theory of flux pinning in inhomogeneous media; theory of ac losses in Type II superconductors.

14. MAGNETIC AND ELECTRONIC PROPERTIES OF SOLIDS THEORY — $137,200 — 02-03
S. H. Liu, S. K. Sinha,
L. Hodges, B. N. Harmon,
D. L. Johnson

Electronic properties of metals and their relationship to magnetic and lattice properties; band structure and Fermi surface calculations of transition metals and their compounds; charge and spin distributions and neutron form factor calculations of transition metals; d-f exchange in rare-earth metals; magnetic excitations in disordered spin systems; lattice instability and charge-density-wave states in metals, alloys, and metallic compounds.

AMES LABORATORY
Chemistry Division -03-
J. D. Corbett - Phone: 294-3086

15. X-RAY AND NEUTRON CRYSTALLOGRAPHY — $198,000 — 03-01
R. A. Jacobson, J. E. Benson, B. J. Helland

Development and extension of X-ray and neutron diffraction techniques; structural methods in the solid state, insecticides, herbicides, hydrides, potential superconductors, and materials exhibiting weak solid state interactions; structural studies of liquid alkali metal solutions.

16. INTERACTIONS IN SOLIDS — $ 54,000 — 03-01
B. C. Gerstein

Magnetic behavior studied by heat capacity, initial susceptibility, EPR and NMR techniques; interactions in one- and two-dimensions.

17. LOW OXIDATION STATES IN INORGANIC SYSTEMS — $120,000 — 03-01
J. D. Corbett

Synthesis, structure and equilibrium reactions of metallic elements under anaerobic, high temperature, and reducing conditions (e.g., for Sc, Ti, Zr, Hf, Mo, rare earths); structures exhibiting metal-metal bonding, anisotropic conduction; homopolyatomic ions (e.g., of Pb, Bi, Se, Te, I); ionic intermetallic phases.

18. CHEMISTRY OF HEAVY TRANSITION METALS — $ 92,000 — 03-01
R. E. McCarley

Chemistry of heavy transition elements, especially Nb, Ta, Mo, W; synthesis of dimeric and cluster compounds with strong metal-metal bonds; properties and reactions of metal cluster compounds with potential for energy storage and catalytic applications; compounds with unusual reactivity.

19. LIQUID METALS — $116,000 — 03-02
R. G. Bautista, G. Burnet, M. J. Murtha

Heat capacity of liquid rare earth metals by levitation calorimetry; liquid metal purification using solid absorbents; recovery of metals from fly ash using calcination/hydrometallurgical processing.

AMES LABORATORY
Chemistry Division -03- (Continued)

20. METAL HALIDES — $ 30,000 — 03-02
R. G. Bautista

Decomposition equilibria of noble metal halides by simultaneous torque-Knudsen technique.

21. MASS TRANSFER AND TRANSPORT IN FLUIDS AND PARTICULATE SYSTEMS — $109,000 — 03-02
L. E. Burkhart

Particle and fluid motion from numerical solution of the Navier-Stokes equations and from high-speed photography; motion and stability of fluids near free surfaces; transport near interfaces, especially drops and bubbles; particle size distribution and morphology in preparation of fine powders; reaction kinetics in multicomponent mass transfer systems involving chemical reaction.

22. HIGH TEMPERATURE CHEMISTRY — $126,000 — 03-03
H. F. Franzen, R. G. Bautista

Structure and bonding in refractory compounds, particularly, metal-rich transition metal chalcogenides; high temperature techniques, phase equilibria, X-ray photoelectron spectroscopy of refractory solids; basic optical pyrometry with emphasis on variation in normal spectral emittance with temperature and surface properties.

23. SURFACE CHEMISTRY AND CATALYSIS — $219,000 — 03-03
R. S. Hansen, B. C. Gerstein

Heterogeneous catalysis by metals and semiconductors, with emphases on clean surface techniques such as field emission microscopy, flash desorption spectroscopy, and single crystal face catalysis; electrical double layer properties and their alteration by absorption; mechanical and flow properties of interfaces; structures of molecular solids as studied by pulsed and multiple pulsed NMR and ESR; chemical structures in coal; molecular motion in solids.

ARGONNE NATIONAL LABORATORY
9700 South Cass Avenue
Argonne, Illinois 60439
Phone: Area Code 312 - 739-7711

Materials Science Division -01
B. R. T. Frost - Phone: 739-2221
N. L. Peterson - Phone: 739-2222

24. ALLOY PROPERTIES $505,000 01-01
F. Y. Fradin, A. T. Aldred, D. J. Lam,
F. M. Mueller, B. W. Veal, Jr.,
G. Cinader, J. S. Lannin, W. L. Procarione

Electronic structure of metals with emphasis on actinides; alloy chemistry of binary compounds of Am; magnetic properties of actinide compounds with increasing emphasis on heavier actinides; NMR on actinide compounds; optical reflectivity and X-ray photoelectron studies of actinide metals and compounds; crystal field theory of actinides; theoretical calculations of the band structure of actinides and of the electronic structure of Mo with dilute impurities and defects; theory of electron-phonon interactions and superconductivity; electronic conduction processes and electronic structure of ceramic materials for MHD applications.

25. SCATTERING STUDIES $573,000 01-01
M. H. Mueller, G. H. Lander,
J. Faber

Magnetic Scattering of neutrons from actinide-based binary compounds with localized moments; inelastic neutron scattering for crystal-field effects in actinides; polarized neutron study of actinides for form factor determination; low temperature X-ray studies to identify distortions from magnetic ordering; crystal structures of palladium and thorium hydrides; defect structures in the ZrO_2-CeO_2 binary system and perovskite materials for MHD applications.

26. PHYSICAL METALLURGY $354,000 01-01
M. B. Brodsky, A. J. Arko,
R. J. Trainor, Jr.

Electronic structures of actinide metals, alloys, and compounds; low temperature specific heat measurements; electrical resistivity; magnetic susceptibility and Mössbauer effect of actinide alloys and compounds to study spin fluctuations, de Haas-van Alphen effect in actinide metals and compounds; scattering of electrons by lattice defects.

ARGONNE NATIONAL LABORATORY
Materials Science Division -01- (Continued)

27. MECHANICAL PROPERTIES $386,000 01-02
U. F. Kocks, E.S.P. Das, A.P.L. Turner,
R. A. Mulford, R. O. Scattergood,
J. L. Routbort, H. Mecking, R. Labusch

Theoretical and experimental research on fundamental aspects of the mechanical properties of metallic and ceramic solids; computer simulations of the flow stress, strengthening mechanisms, dislocation motion through individual obstacles and random arrays; cyclic hardening and dynamical recovery; constitutive relations for plasticity, creep and fatigue of metals and ceramics; structure characterization of deformed crystals by X-ray diffraction.

28. METAL PHYSICS $838,000 01-03
R. W. Siegel, A. S. Berger, W. K. Chen,
E. S. Fisher, M. J. Fluss, N. Q. Lam,
J. N. Mundy, S. J. Rothman,
D. G. Westlake, R. E. Einziger,
N. S. Choudhury, K. H. Faber,
L. C. Smedskjaer, S. W. Tam

Atomic mechanisms of self-diffusion and impurity diffusion in solids; effects of hydrogen on physical properties of transition metals; directional dependence of elastic properties; the properties of point-defects and defect clusters using positron annihilation and electron microscopy techniques; self-diffusion in W and Nb and the isotope effect; effect of irradiation on diffusion in Ag and Nb; ionic transport mechanisms in solid electrolytes; defect structure, cation diffusion and grain boundary diffusion in oxides; diffusivity and solubility of H in V and Nb; interstitial relaxation in V and Nb; studies of point defects in bcc refractory metals; vacancy clustering and vacancy-solute interactions using positron annihilation and electron microscopy techniques.

29. SUPERCONDUCTIVITY $190,000 01-03
F. Y. Fradin, G. S. Knapp,
G. Cinader, S. D. Bader

Electron-phonon interaction in high-transition-temperature superconductors; NMR and Mössbauer effect studies of the A-15 compounds Nb_3X and V_3X where X is a nontransition element and of the hydrides of Pd and Pd-Sn and Pd-Ag alloys; the effect of magnetic impurities on the critical magnetic field in $LaSn_3$, $LaIn_3$, and $LaPb_3$; anharmonic effects in Nb_3X and Laves-phase compounds and $PbMo_6S_8$ deduced from heat-capacity studies; X-ray photoemission studies of the band structure of A-15 compounds and superconducting palladium hydrides.

ARGONNE NATIONAL LABORATORY
Materials Science Division -01- (Continued)

30. NEUTRON IRRADIATION $517,000 01-04
T. H. Blewitt, B. S. Brown,
M. A. Kirk, Jr., B. A. Loomis,
R. C. Birtcher, E. C. Kramer

Point defect production, annihilation and clustering; radiation effects in superconductors; neutron sputtering; flux pinning by defect clusters and voids; particle emission by neutron bombardment; replacement collision sequences; saturation effects and the recombination volume; void swelling in Nb and Nb-Zr alloys as a function of dose, temperature and oxygen content during simultaneous irradiation with 4 MeV Ni^+ and He^+ ions; radiation sources include the CP-5 low temperature facility and the 4 MeV Dynamitron.

31. CHARGED PARTICLE IRRADIATION $464,000 01-04
K. L. Merkle, R. S. Averback,
R. Benedek, R. L. Lyles, Jr.,
P. P. Pronko, K. H. Ecker

TEM studies of displacement cascades produced by 300 KeV self-ion bombardment and 14 MeV neutron; dechanneling from damage clusters; replacement sequences and long-range diffusion of interstitials; influence of channeling on defect production; resistivity studies of self-ion bombarded thin films; theory of focusing sequences; localized vibrational mode frequencies of self-interstitials; migration and clustering of defects and inert gases; lattice locations of interstitial impurities; interaction of gas atoms with displacement damage; sputtering due to energetic displacement cascades; radiation sources include 300 KeV heavy ion accelerator, 4 MeV Dynamitron, 14 MeV neutron source at LLL and high voltage electron microscope.

32. KINETIC STUDIES $608,000 01-04
H. Wiedersich, F. V. Nolfi, Jr.,
P. R. Okamoto, D. I. Potter,
M. D. Rechtin, A. Taylor,
S. P. Choi, G. R. Davidson,
R. J. DiMelfi, R. F. Mattas

Investigations into forces and mechanisms that lead to the formation of defect aggregates and precipitates and other inhomogeneous distributions of atoms in solids during irradiation; solute

ARGONNE NATIONAL LABORATORY
Materials Science Division -01- (Continued)

32. KINETIC STUDIES (Cont'd)

segregation to voids and free surfaces during irradiation; effect of irradiations on the microstructure of two-phase alloys - dynamic dissolution and reprecipitation; dimensional changes caused by gas-bubble nucleations; growth and coagulation; stress fields around voids and their interaction with defects and other voids; the effect of fine precipitate dispersions, solute additions, helium, and projectile mass on void formation during ion bombardment; effects of interstitial loop structure and stress-induced preferred loop orientation on irradiation creep; damage structure produced during high-temperature ion bombardment of oxides; radiation sources include 300 KeV heavy-ion accelerator, 4 MeV Dynamitron, and high voltage electron microscope.

Solid State Science Division -02-
D. L. Price - Phone: 739-3141

33. NEUTRON SCATTERING STUDIES $923,000 02-01
T. Brun, J. M. Carpenter,
G. Felcher, D. L. Price,
S. K. Sinha, T. Worlton

Research is conducted in neutron inelastic scattering, neutron diffraction in magnetic systems and high pressure neutron diffraction; a major effort is devoted to development and prototype testing of an intense pulsed spallation neutron source; both steady-state and time-of-flight techniques are employed at the CP-5 research reactor while the spallation prototype employs the ZGS proton injector-booster; facilities include a thermal neutron time-of-flight spectrometer, triple-axis spectrometer, time-of-flight diffractometer and a two-axis diffractometer; current studies include diffusion of hydrogen in solid and liquid metals, as well as the structure and lattice dynamics of hydrides; the dynamics of liquids including molten salts and He^3-He^4 solutions; collective effects in the kinetic behavior of dense fluids; the dynamics and structure of amorphous materials; molecular reorientation and dynamics of molecular crystals (KCN, NaCN, NH_4Cl, NH_4Br); dynamics of superconductors, amorphous metals and alloys; Schwinger and Huang scattering; crystal field interactions and magnetic effects in rare-earth intermetallics; magnetic scattering in magnetically ordered systems; spin glasses and rare-earth magnetic form factors; high pressure diffraction and compressibility measurements of metals, ionic crystals, ice and high temperature ceramics.

ARGONNE NATIONAL LABORATORY
Solid State Science Division -02-

34. MATERIALS PREPARATION AND CHARACTERIZATION — $136,000 — 02-02
S. Susman, D. Hinks

Preparation of research samples of metal, insulator and semiconductor single crystals with documented physical and chemical properties; materials of current interest include alkali halides and cyanides, rare-earth oxides and hexaborides, rare-earth alloys and rare earths in metallic matrices; investigation of refractory oxides of interest in connection with MHD electrode problems; oxides under study include pure and doped Y_2O_3 and CeO_2; investigation of mechanisms involved in purification and the development of clean-room facilities and crystal growth techniques.

35. DEFECTS AND IMPURITIES IN NONMETALLIC SYSTEMS — $315,000 — 02-02
P. Yuster, C. Delbecq,
S. Marshall, J. McMillan

Study of defects and impurities in nonmetallic crystals and the processes occurring during and after exposure to ionizing radiation; nature of the defects and their interaction with host-crystal electronic states, lattice modes and with each other; structure and reorientation dynamics of molecular ion centers (Cl_2^-, $BrCl^-$) in alkali halides, heavy metal centers in ionic crystals including heavy-metal-molecular-ion complexes such as $(ClSnCl)^-$, the effect of magnetic fields on recombination luminescence, ESR studies of impurities (Cr^{3+} in MgO, Cu^{2+} in NH_4Cl, Gd^{3+} in YAG and in ThO, Tl and Pb centers in KCl and V^{2+} in SrF_2), the coordination of Cu^{++} in aminoacids, and temperature- and magnetic-field dependence of spin relaxation times.

36. LOW TEMPERATURE STUDIES — $213,000 — 02-02
H. A. Kierstead, P. Roach,
R. Webb, H. Culbert

Studies of properties of quantum liquids and solids at very low temperature and the measurement of specific heats of superconducting and magnetic materials at low temperatures; precision measurements of the thermodynamic properties of He^3, He^4, and He^3-He^4 mixtures near phase transitions, properties of superfluid phases of He^3, sound propagation and ion mobility in new He^3 phases, adiabatic cooling by nuclear demagnetization, specific heat measurements on Kondo systems (La:Ce); rare-earth sesquioxides displaying antiferromagnetic ordering, and mixed phase alloys (Pb-Na).

ARGONNE NATIONAL LABORATORY
Solid State Science Division -02- (Continued)

37. SUPERCONDUCTIVITY STUDIES — $344,000 — 02-02
R. Huebener, K. Gray,
C. Falco, J. Hafstrom

Nonequilibrium processes in superconductors and clarification of the relation between metallurgical and superconducting properties in type II materials; quantum interference effects, magnetic structures and transport properties of superconductors are studied using high-resolution magneto-optical techniques, tunnel junctions and electrical noise power measurements; dynamic behavior of flux structures, flux flow, flux pinning and the relaxation time for magnetic flux penetration, electrical and magnetic properties and superconductivity breakdown at very high transport currents; optical excitation of nonequilibrium states in superconductors, properties of magnetically-coupled superconducting films, Josephson weak links, and the preparation of high T_c films of Nb and Nb compounds by sputtering and vapor deposition methods.

38. PHASE TRANSITIONS AND CATALYSIS — $222,000 — 02-02
L. Guttman, D. O'Reilly

Studies of phase transitions in order-disorder systems; the structure of glassy materials; the dynamics of molecules in amorphous systems and the properties of atoms and molecules adsorbed on surfaces; techniques include NMR, ESR and ENDOR spectroscopy and extensive computer modeling of complex systems; models of liquids and amorphous solids; computer simulation of random network models of glasses; spin-echo measurements of self diffusion in H_2, D_2, and H_2-D_2 mixtures; NMR determination of structure in amorphous materials such as glassy BeF_2; magnetic resonance studies of surface states; diffusion of adsorbed species on surfaces and catalysis.

39. MAGNETIC PROPERTIES — $144,000 — 02-02
B. D. Dunlap, G. K. Shenoy

Magnetic properties of metals, alloys and compounds are studied with particular emphasis on local-moment vs. itinerant models of magnetism; measurement of hyperfine interactions, spin-lattice relaxation times and crystal-field effects in lanthanide and actinide materials with the Mössbauer effect; studies of the

ARGONNE NATIONAL LABORATORY
Solid State Science Division -02- (Continued)

39. MAGNETIC PROPERTIES (Cont'd)

degree of localization of 5f electrons in neptunium and americium Laves phase intermetallics; measurements of crystal field splittings and electronic relaxation effects in cryolites; studies of hydrogen-bearing compounds such as ErH_2 and $(Er)YH_2$ as well as other rare-earth hydrides; hyperfine interactions and electron relaxation effects in hemoglobin compounds; properties of dilute magnetic alloys employing neutron scattering, magnetization and specific heat measurements; local moment formation and the Kondo effect in Ce alloys and compounds such as $CeAl_3$, $(La,Ce)Al_3$ and $CeSn_3$; competition between the Kondo effect and superconductivity with tunnel diodes made of $La_{1-x}Ce_xTh_y$.

40. ELECTRONIC PROPERTIES $173,000 02-02
L. Windmiller, G. Crabtree

Studies of the Fermi surface in metals, alloys and intermetallic compounds via the de Haas-van Alphen Effect; measurement of conduction-electron effective masses and g-factors and studies of the scattering of electrons by impurities, lattice defects and local moments; experimental determination of g-factors at the Fermi surface in Au and complementary APW g-factor calculations; studies of conduction states with f-like character in the actinide compounds URh_3 and UGe_3; measurements of the Fermi surface in Mo, W and Nb and associated band structure calculations; Fermi surface and scattering lifetime measurements in Au, Pd, and Pt and dilute alloys of these metals with Fe, Co and Ni; and studies of conduction electron scattering by vacancies in Au and Pt and by dislocation loops in Cu.

41. SOLID STATE THEORY $370,000 02-03
T. Arai, T. Gilbert, D. Koelling,
F. Mueller, A. Rahman, J. Robinson,
D. Smith, P. Vashishta

Electron correlation at metallic densities; itinerant theory of magnetism and electron correlations; electron-hole plasmas; hydrogen in metals; defects in metals and insulators; temperature dependence of magnetic ordering in rare-earth metals and alloys; localized moments and the Kondo effect; cumulant perturbation expansion for spins; molecular dynamics calculations; theory of neutron scattering measurements; vortex motion in quantum liquids; electron-phonon interactions; structure and interactions of atoms in molecules and solids; optical and electronic properties of insulators; electronic structure and properties of metals; actinide metals and intermetallic compounds; superconductivity and superfluidity; magnetism of transition metal alloys.

ARGONNE NATIONAL LABORATORY
Solid State Science Division -02- (Continued)

42. ENERGETIC PARTICLE INTERACTION $310,000 02-04
J. Jackson, W. Primak,
P. Vashishta

Production and recovery of radiation damage by ions, electrons and neutrons in metals and insulators; elementary defects and their interactions; defect production and trapping rates; distribution of defects; properties of divacancies and larger cluster impurity effects; field ion microscopy; deviations from Matthiessen's rule; theoretical studies of defect formation and migration in metals; materials currently under study include lead, platinum, nickel, indium, mercury, molybdenum and tungsten; radiation damage in insulators includes work on lithium niobate, sapphire, spinel, lucalox, barium titinate, quartz, vitreous silica, and glasses; optical and electrical effects; dimensional changes; stress formation and relief; migration of implanted ions to surfaces and voids; surface destruction; blister formation and spallation.

Chemistry Division -03-
P. R. Fields - Phone: 739-2666

43. NEUTRON SCATTERING AND X-RAY DIFFRACTION STUDIES $515,000 03-01
S. W. Peterson, M. Atoji,
J. M. Williams, H. E. Flotow,
E. G. Sherry

Chemical synthesis and materials evaluation (particularly by neutron-structure and bonding studies) of highly anisotropic electrically-conducting inorganic compounds such as the Krogmann salts $K_2Pt(CN)_4Br_{0.3}\cdot 3H_2O$ and $K_2Pt(CN)_4Cl_{0.3}\cdot 3H_2O$ and of complex metal hydrides of potential use in catalytic-hydrogenation processes; neutron-diffraction studies of magnetic and related materials in a wide temperature range (2-1800°K) with applied fields of up to 25 Kilogauss; neutron quasi-elastic-scattering studies on single crystals of TaH_x (to understand the mechanism for hydrogen diffusion) and lattice dynamic studies of various single-crystal samples of PdD_x; and X-ray phase studies concerning: ion-bombarded materials of interest in the CTR program; characterization of hydride phases formed on trapping hydrogen or deuterium in metallic films; structure and superlattice investigations of the cation-deficient cyanoplatinate one-dimensional conducting salts; structure studies of heavy-element compounds which may form in fast-breeder fuel; structure and mechanistic studies of organophosphate actinide-waste-product extractants.

ARGONNE NATIONAL LABORATORY
Chemistry Division -03- (Continued)

44. HIGH TEMPERATURE CHEMISTRY $355,000 03-03
R. J. Thorn, R. J. Ackermann,
J. R. McCreary, E. G. Rauh,
G. H. Winslow

High-temperature thermodynamic, transport, and structural properties of inorganic, ceramic materials: oxides, carbides, sulfides, and fluorides; thermochemical systematics of lanthanide and actinide compounds, both solids and gaseous molecules; determination and role of energies of lattice defects and valence states in the thermochemical and diffusional properties of ceramic, refractory materials; derivation of statistical-mechanical equations of state based on defects and valence energies of ternary nonstoichiometric phases; determination of the thermochemical properties and equilibria of gaseous molecules and the partial molar thermochemical properties of solids and their relation to structures including defects; high temperature X-ray-diffraction investigations of defect-structures, thermal disorder and lattice expansions; photoelectron-spectroscopic studies of valence-band structures of 4f- and 5f-elements in various oxidation states; derivation therefrom of a rational, quantitative scale for valence-states energies in solid-state chemistry; thermodynamics and thermochemistry of self diffusion and chemical diffusion in nonstoichiometric phases such as (U Ln)$O_{2\pm x}$; diffusion-limited sublimation in uranium carbides; Knudsen mass and momentum effusion and mass-spectrometric measurements of partial vapor pressures; precise measurements (0.05°C) of temperature above 1000°C.

45. LOW TEMPERATURE CALORIMETRY $119,000 03-03
D. W. Osborne, H. E. Flotow

Heat capacity measurements and determination of entropies, enthalpies, and Gibbs energies from 0.1 to 350K for use in thermodynamic calculations at higher temperatures; emphasis is being placed on inorganic compounds of importance in energy systems, especially the LMFBR and various advanced nuclear reactors; among the compounds currently being studied are: plutonium oxides, nitrides, and carbides made from the longer-lived plutonium isotope ^{242}Pu; uranium oxides, sulfides, and selenides; sodium-uranium-oxygen compounds; U_3Si (a possible fuel for an advanced reactor); compounds of high-yield fission products (e.g., Cs, Ba, and Mo) with uranium and chromium.

ARGONNE NATIONAL LABORATORY
Chemistry Division -03- (Continued)

46. SURFACE CHEMISTRY OF ENERGETIC REACTIVE-PARTICLE INTERACTIONS WITH SOLIDS AND SPECTROSCOPY OF HIGH TEMPERATURE SYSTEMS — $296,000 — 03-03
D. M. Gruen, I. Sheft, R. L. McBeth, R. B. Wright

Mechanism of chemical sputtering; characterization and yield measurements of sputtered products from metal, insulator and semiconductor surfaces bombarded with 15 Kev hydrogen isotopic ions; mechanism of trapping, including chemical trapping of hydrogen isotopes in surfaces; characterization of surface compounds and surface structural changes produced by ion implantation using ATR-IR, laser Raman, X-ray diffraction and SEM techniques; photon absorption measurements of metal-atom and molecular dopants in solid-deuterium matrices; reactions of metal atoms with small molecules to form novel organo-metallic complexes at cryogenic temperatures in noble-gas matrices; matrix-isolation spectroscopy of selected atomic and molecular species; spectroscopy of molten salt systems - most recently of transition metal ions in molten alkali-metal carbonates.

Chemical Engineering Division -03-
L. Burris - Phone: 739-2594
F. A. Cafasso - Phone: 739-3672

47. LIQUID METALS CHEMISTRY — $200,000 — 03-02
V. A. Maroni, E. Veleckis, W. Calaway, R. M. Yonco

Thermodynamic and transport properties of liquid alkali metals and their solutions; phase diagrams and solution thermodynamics of Li-D_2, Li-T_2, and Li-Al-H_2 systems by tensimetric methods; pressure composition isotherms for LiH and LiD in liquid lithium below the monotectic; the Li-LiO_2 phase diagram; distribution of oxygen, nitrogen and carbon between liquid lithium and selected lithium halide eutectic salts; study of binary Li-Li_2C_2 systems; diffusion coefficients of hydrogen and deuterium in liquid Li, Na, and NaK as a function of temperature; interactions of lithium with refractory metals and alloys.

ARGONNE NATIONAL LABORATORY
Chemical Engineering Division -03- (Continued)

48. MOLTEN SALT CHEMISTRY $150,000 03-02
M. Blander, G. Papatheodorou,
M. Saboungi

Calculation of phase diagrams and other thermodynamic properties of molten salts using fundamental solution theories; conformal ionic solution theory; liquidus diagrams of multicomponent molten salt systems, statistical mechanics of ionic systems; structure of molten salt systems involving acidic salts such as $AlCl_3$ and $ZnCl_2$; thermodynamic and spectroscopic properties of salt vapors; identification of high temperature associated vapor species formed between $AlCl_3$, $ZnCl_2$ or HCl with other salts; laser-Raman spectral studies, vapor-transport measurements, chemical separations using vapor-transport.

49. CHEMISTRY OF MATERIALS $150,000 03-02
P. T. Cunningham, B. Holt,
W. Hubble, S. Johnson

Chemistry of sulfate and nitrate airborne particulate and their formation mechanisms; methodology for particulate characterization; size, time, and spatial variations in the chemistry of airborne particulates in Chicago, St. Louis, and Riverside, California; infra-red spectroscopy, application to determining the distribution and concentration of carbonate, silica, silicate, nitrate, sulfate, ammonium, hydrocarbon, etc. in particulates; laboratory simulation of atmospheric conditions for the study of sulfate and nitrate particle formation; evaluation of other sulfate and nitrate formation mechanisms; kinetics of sulfur fixation by half-calcined dolomite and of the regeneration of the active material from sulfated calcine, mechanism of reactions.

50. THERMODYNAMIC PROPERTIES OF INORGANIC SUBSTANCES $260,000 03-02
P. A. G. O'Hare, W. N. Hubbard,
G. K. Johnson, M. Ader,
D. R. Fredrickson

Experimental and computed thermodynamic properties of inorganic materials; interpretation and prediction of materials properties such as enthalpies of formation and bonding energies; standard enthalpies of formation ($\Delta H^\circ_{f(298)}$), high temperature enthalpy increments ($H^\circ_T - H^\circ_{298}$); oxygen and fluorine bomb calorimetry, hypergolic reaction calorimetry, flow calorimetry, drop calorimetry to 2000 K; enthalpies of formation of hyperstoichiometric cesium chromates, $NaVO_2$, $CsAlO_2$, WS_2, TiS, $Ti_4C_2S_2$, TiN, βLiAl, rare earth trifluorides, VF_3, Li_2C_2; transuranium compounds αUS_2, $CaUO_4$, $MgUO_4$.

ARGONNE NATIONAL LABORATORY
Chemical Engineering Division -03- (Continued)

51. HEAT TRANSFER MATERIALS — $100,000 — 03-02
M. Blander, T. Renner

Studies on materials which exhibit strong or unusual bonding in the vapor and, hence, are potentially useful as heat transfer fluids; nature of vapor species, equilibrium constants, relative bond strengths, P-V-T properties, methanol, ethanol, trifluoroethanol, thermal conductivities.

52. PHYSICAL CHEMISTRY OF ELECTRO-CHEMICAL ENERGY STORAGE SYSTEMS — $ 55,000 — 03-02
R. K. Steunenberg, J. R. Selman, A. E. Martin, M. Blander, M. Saboungi

Electrochemical and phase studies of cathode materials in lithium-aluminum/LiCl-KCl/metal sulfide batteries; electrode reaction kinetics and mechanisms, electromotive force measurements, lithium-aluminum, lithium-magnesium, lithium-zinc alloys, chemical activity, deviations from ideality; phase relationships of lithium sulfide, iron sulfide, copper sulfide, cobalt sulfide systems, solid solubility, compound formation, lithium-aluminum alloy, exchange current density, lithium-ion diffusion in molten salts, solid-state diffusion in lithium-aluminum, chronopotentiometry on iron sulfide electrodes, binary lithium alloys, binary sodium alloys, ternary alloys, solution thermodynamics, models for the prediction of the thermodynamic properties of ternary alloy systems.

53. BUBBLE NUCLEATION — $ 35,000 — 03-02
M. Blander and Hann-Shen Huang

Homogenous and heterogenous bubble nucleation and explosive boiling studies; P-V-T properties of stable and metastable fluids and testing of equations of state; contact vapor explosion mechanisms, nucleation theory, molecular dynamic calculations; technique development for limit of superheat measurements for hydrocarbons and ethers; studies on the heterogenous nucleation of water.

BROOKHAVEN NATIONAL LABORATORY
Upton, Long Island, New York 11973
Phone: Area Code 516 - 345-2100

Materials Science Division -01-
D. H. Gurinsky - Phone: 345-3504

54. SUPERCONDUCTIVITY $300,000 01-03
A. Sweedler, R. Viswanathan,
O. Kammerer, R. Caton, D. Gurinsky

Fundamental properties of superconductors such as long range order, stability, stoichiometry, low temperature phase transitions, heat capacity of individual phases, preparation of and orientation of single crystals of A-15 superconductors; use of x-ray-neutron diffraction, LEED, Auger resistivity; nonconventional methods of preparation of high T_c superconductors.

55. RELATIONSHIP BETWEEN PROPERTIES AND STRUCTURES $345,000 01-03
M. Suenaga, T. Luhman,
D. Dew-Hughes, C. Pande,
C. Klamut, D. Gurinsky

Methods of preparation of high field, high critical temperature, high current superconductors; preparation of multifilamentary A-15 superconductors; kinetics and mechanisms of formation of A-15 superconductors; relationship of defect structure and superconducting properties, stabilization and strengthening of multifilamentary conductors; study of ac losses in A-15 superconductors.

56. RADIATION DAMAGE $147,000 01-04
L. Snead, A. Sweedler,
D. Gurinsky, R. Viswanathan,
C. Pande

Study of effects of low energy and 30 BeV protons, 14 MeV neutrons, thermal and fast >1 MeV neutrons, and low energy electrons on properties of superconductors; intercomparison of damage effectiveness; annealing studies of irradiated superconductors; effect of temperature on damage rates; heat capacity of irradiated superconductors; defect structure of irradiated superconductors.

BROOKHAVEN NATIONAL LABORATORY
Physics Department -02-
B. C. Frazer - Phone 345-3876

57. NEUTRON SCATTERING - MAGNETIC SYSTEMS — $495,000 — 02-01
G. Shirane, L. Passell, M. Iizumi, J. D. Axe, S. M. Shapiro, J. W. Lynn

Neutron scattering studies on the structure and dynamics of magnetic materials; spin waves in amorphous ferromagnets; magnetic critical scattering in rare earth pnictides and in Co metal; tricriticality in $FeCl_2$; spin waves and spin reorientation in rare earth orthoferrites; development of broad band polarizing monochromators using multilayer films.

58. NEUTRON SCATTERING - PHASE TRANSITIONS — $465,000 — 02-01
G. Shirane, J. D. Axe, H. Taub, S. M. Shapiro, R. Pynn, Y. Fujii, K. Carneiro, J. W. Lynn

Neutron scattering studies of structural phase transformations and of dynamical fluctuations of ordering parameters associated with them; pressure induced transition in TeO_2; second order metal-insulator transformation in NbO_2; valence fluctuations in SmS and in magnetite; charge density waves in transitions in pseudo one- and two-dimensional metals; martensitic phase transformations in "ω"-phase alloys.

59. NEUTRON SCATTERING - ELEMENTARY EXCITATIONS IN SOLIDS — $395,000 — 02-01
J. D. Axe, G. Shirane, R. Pynn, Y. Fujii

Neutron spectroscopy of low-lying thermally excited energy states in solids; phonon studies in Ar-36 and high density Ne crystals; lattice dynamics of other molecular crystals, α-N_2 and DCl; effect of a magnetic field on phonon lifetimes in Nb; phonons associated with the indirect band gap in AgBr; development of new and improved experimental and analytical techniques for inelastic scattering studies.

BROOKHAVEN NATIONAL LABORATORY
Physics Department -02- (Continued

60. NEUTRON SCATTERING - PARTIALLY ORDERED SYSTEMS — $300,000 — 02-01
L. Passell, J. D. Axe, G. Shirane
K. Carneiro, H. Taub, R. Pynn, D. E. Cox

Neutron scattering studies of short-range order and of both collective and localized excitations in liquids, amorphous solids, dense gases, and certain thin films and surfaces; structure and dynamics of Ar monolayer films adsorbed on graphite; analysis of x-ray and neutron diffraction data from liquid crystals; inelastic coherent neutron scattering in amorphous solids; structure and dynamics of materials with high ionic conductivity; defect structure and phase relationships in CeO_{2-x}; neutron induced disorder in superconducting A-15 compounds.

61. EXPERIMENTAL RESEARCH - SUPERCONDUCTIVITY — $344,000 — 02-02
M. Strongin, J. Strozier,
R. Viswanathan, M. Yu,
C. Varmazis, H. Lutz

Superconductivity in crystalline ultra-thin films on semi-conductor surfaces; co-deposition of elements to study metastable phases in A-15 films; measurements of critical currents in thin film superconductors; properties of Josephson junctions and junction arrays; specific heat of thin film superconductors and amorphous films; nucleation of the superconducting state at metal surfaces and relationships with surface impurities; alloys of Sn and Ge at the surface of niobium; structural studies using LEED and AES; studies of the rf transition in superconductors.

62. EXPERIMENTAL RESEARCH - LOW TEMPERATURE PHYSICS — $176,000 — 02-02
V. J. Emery, E. B. Osgood,
W. C. Thomlinson

Study of the condensed phases of liquid helium; current emphasis on the measurement of various properties of superfluid He-3 and the development of a nuclear cooling apparatus for this purpose; long-range continuing interest in transport properties at low temperatures.

BROOKHAVEN NATIONAL LABORATORY
Physics Department -02- (Continued)

63. THEORETICAL RESEARCH — $415,000 — 02-03
M. Blume, G. J. Dienes, V. J. Emery, R. E. Watson, D. O. Welch, S. Krinsky, D. Mukamel, P. Bak

Phase transitions and critical phenomena, magnetism, liquid helium (He-3, He-4, and their mixtures), ferroelectricity, electronic structure of metals and alloys, and crystal defect physics; properties of one- and two-dimensional materials; staggered magnetic fields in antiferromagnets; computer studies of one-dimensional and random magnetic systems; superfluidity in liquid He-3; analysis of soft x-ray photoemission data from alloys; dynamics and kinetics of crowdion interactions; defect-defect interactions and phase transitions; properties of superionic conductors; studies of valence electron distributions in crystals; Mössbauer and spin resonance line shapes and perturbed angular correlations in randomly varying external fields; fluctuations and surface superconductivity.

64. PARTICLE-SOLID INTERACTIONS - RADIATION EFFECTS RESEARCH — $450,000 — 02-04
A. N. Goland, P. W. Levy, D. E. Cox, K. J. Swyler, K. G. Lynn

Defect studies employing positron-annihilation lifetime and Doppler-broadening measurements on irradiated metal samples; simultaneous optical-absorption and luminescence measurements during electron or gamma irradiation of alkali halides, ceramics and optical-quality glasses; electron irradiation studies of metals preirradiated with 14-MeV neutrons; thermoluminescence of TLD-100 dosimeter crystals; effects of radiation on thermal decomposition kinetics in ammonium perchlorate; calculations of radiation damage parameters for CTR-related neutron sources.

BROOKHAVEN NATIONAL LABORATORY
Physics Department -02- (Continued)

65. PARTICLE-SOLID INTERACTIONS - PROPERTIES OF IDEAL AND NONIDEAL SOLIDS — $400,000 — 02-04
A. N. Goland, P. W. Levy, H. Engstrom, K. G. Lynn

Utilization of particle-solid interactions as diagnostic probes in solid-state investigations; studies of point defects and dislocations in metals by positron annihilation lifetime and Doppler-broadening measurements; x-ray and neutron diffraction studies; Raman scattering from defects in sodium chlorate crystals; axial channeling of protons in very thin single crystals; thermoluminescence of inorganic crystals, including studies on minerals from ore sites.

66. PARTICLE-SOLID INTERACTIONS - HIGH TEMPERATURE MATERIALS — $ 80,000 — 02-04
D. E. Cox, C. Khattak, A. N. Goland

High-temperature materials, especially as related to probably requirements of MHD and CTR systems; preparation of the simple oxides, Al_2O_3 and Y_2O_3 and various perovskite oxides; electrical conductivity, x-ray and neutron diffraction studies of pure and doped crystals in the $LaCrO_3$ system, $BaCeO_3$, and $BaZrO_3$; neutron diffraction studies of defect structures and phase relationships in the CeO_{2-x} system; research on high electronic conductivity ceramics.

HOLIFIELD NATIONAL LABORATORY
P. O. Box X
Oak Ridge, Tennessee 37830
Phone: Area Code 615 483-8611

Metals and Ceramics Division -01-
J. R. Weir, Jr. - Phone: 483-1925
C. J. McHargue - Phone: 483-1278

67. FUNDAMENTAL CERAMICS RESEARCH $284,000 01-01
J. Brynestad, S. L. Bennett, R. H. Busey, H. F. Holmes, H. P. Krautwasser

Structure of pyrocarbons; thermodynamics, structure and stability of tellurides; boron carbides, uranium nitrides and europium compounds; properties of potential solid blanket materials for fusion reactors; grain boundary structure and composition of ceramics.

68. CRYSTAL PHYSICS $178,000 01-01
G. W. Clark, J. D. Holder, C. B. Finch

Directional solidification of metal-metal oxide binary systems; development of models for heat and mass transfer during coupled solidifications; evaluation of oxide-matrix composites for high temperature applications in gas turbines and MHD devices; hydrothermally grown quartz; single crystals doped with lanthanides and actinides; definition of important parameters for edge-defined film-fed growth process.

69. THEORETICAL RESEARCH $295,000 01-01
J. S. Faulkner, G. S. Painter, W. H. Butler, J. J. Olson, M. H. Yoo, B. Gyorffy

Anisotropic elastic treatment of elastic energy of dislocations and effect of elastic self-fields on equilibrium shapes of prismatic dislocations; drift flow paths, kinetics, and capture radii for point defects in such fields; KKR band theory for calculating electronic states in periodic crystals having more than one atom per unit cell and to analyze superconducting transition temperatures; multiple-scattering cluster program for electronic states of clusters of Cu, Ni, Fe atoms and effects on stepped surfaces; DVM applied to covalent compounds of interest for potential solar energy applications; CPA treatment of non-stoichiometric compounds.

HOLIFIELD NATIONAL LABORATORY
Metals and Ceramics Division -01- (Continued)

70. STRUCTURE OF METALS AND ALLOYS — $ 60,000 — 01-01
R. O. Williams

Interrelation of thermodynamics and structure of solid solutions; ordering and clustering in Cu-Al and Ni-Mo; morphological and crystallographic relationships of "tweed" structure produced by internal oxidation of Ta-8% W-2% Hf and Nb-1% Zr.

71. FUNDAMENTAL RESEARCH IN X-RAY DIFFRACTION — $194,000 — 01-01
H. L. Yakel, Jr., B. S. Borie,
C. J. Sparks, Jr., R. W. Hendricks

Structures of Eu_2O_3; diffuse x-ray and neutron scattering measurements applied to study of forbidden Bragg reflections and ω-phase formation, transformations in uranium alloys; small angle scattering studies of voids in irradiated materials; inelastic resonance scattering; application of synchrotron x-radiation to study diffraction in solids.

72. DEFORMATION AND MECHANICAL PROPERTIES — $270,000 — 01-02
R. A. Vandermeer, J. C. Ogle,
C. S. Yust

Relationships between structure and deformation and mechanical properties; "memory" effect in U-Nb-Zr alloys; stress effects on transformations from γ-stabilized uranium alloys; fracture in body-centered cubic alloys; recrystallization of rolled tantalum single crystals; deformation and fracture of metal-metal oxide composites; creep of polycrystalline ceramics; role of grain boundaries on deformation processes.

73. SURFACE PHENOMENA — $230,000 — 01-03
J. V. Cathcart, R. E. Pawel,
G. F. Peterson, G. J. Yurek

Mechanisms of alloy oxidation in U-, Ta-, and Nb-base alloys; oxidation generated stresses; structure of oxide films and mobility of elements in them; reaction of composite materials with oxygen, CO-CO_2 mixtures, methane, effects of other gases.

HOLIFIELD NATIONAL LABORATORY
Metals and Ceramics Division -01- (Continued)

74. DIFFUSION IN SOLIDS $230,000 01-03
T. S. Lundy, P. T. Carlson,
R. A. Perkins

Theoretical and experimental studies of atomic migration in solids; interdiffusion and intrinsic diffusion in V-Ti solid solutions; thermotransport of monovalent and divalent impurities in single crystals of NaCl and KCl; thermal gradient and stoichiometric effects on diffusion in UN; chemical and tracer diffusion in Fe-Cr-Ni; hydrogen isotopes in Cr_2O_3.

75. PHYSICAL PROPERTIES RESEARCH $230,000 01-03
D. L. McElroy, R. K. Williams,
J. P. Moore, T. G. Godfrey

Development and application of measurement methods for obtaining accurate physical properties data (thermal conductivity, electrical resistivity, thermopower, specific heat capacity, and coefficient of thermal expansion) from 1.2 to 2600 K; analysis of data for information on energy transport mechanisms and evaluation of theories; refractory metals; nuclear ceramics; effects of stoichiometry, cation-anion mass ratio, and (T/θ_D), on transport properties in ceramics; irradiation effects.

76. METALLURGY OF SUPERCONDUCTING MATERIALS $260,000 01-03
C. C. Koch, D. M. Kroeger,
D. S. Easton, D. J. Griffiths

Effect of metallurgical variables on superconducting properties in Nb- and Tc-base alloys; ac loss mechanisms in Nb and A-15 compounds; fluxoid pinning in Nb-Gd, Nb-Y, and Nb-Hf alloys; properties of sputter deposited $Nb_{12}Al_3Ge$; development of techniques for measuring J; structures in A-15 compounds; low temperature specific heat measurements.

HOLIFIELD NATIONAL LABORATORY
Metals and Ceramics Division -01- (Continued)

77. RADIATION EFFECTS $1,125,000 01-04
J. O. Stiegler, K. Farrell,
E. E. Bloom, J. M. Leitnaker,
W. A. Coghlan, N. H. Packan,
W. G. Wolfer, L.K. Mansur,
R. W. Carpenter, E. A. Kenik,
J. Hastings, T. C. Reiley,
G. Bauer

Void and interstitial loop formation as functions of neutron fluence, spectra, and irradiation temperature; development of quantitative relationship between neutron and heavy ion bombardment; irradiation of Al, Ni, V with self ions and "transmutation products" in Van de Graaff and ORIC; effect of composition on swelling and loss of ductility in Al and Fe-Cr-Ni "model" systems; in situ studies by HVEM; theoretical treatment of nucleation and growth of defect clusters, kinetic effects of accelerated irradiation and stress effects of swelling; simulation of radiation creep; effects of high gas contents on structure and properties; solute segregation during irradiation; effects on phase stability.

Solid State Division -02-
M. K. Wilkinson - Phone: 483-6713
F. W. Young, Jr. - Phone: 483-1704

78. NEUTRON DIFFRACTION $485,000 02-01
W. C. Koehler, J. W. Cable,
H. R. Child, R. M. Moon

Elastic and inelastic scattering of polarized and unpolarized neutrons by magnetic systems; magnetic moment distributions in weakly paramagnetic and diamagnetic systems Sc, Y, Ti, Nb, Bi, Cu(Fe), Cu, and in dilute and concentrated alloys Ni-Cu, Ni-Cr, and Ni-Mn; crystal field levels, spin densities and exchange interactions in cubic Laves phase compounds $LuCo_2$, $TmCo_2$, $TmNi_2$ and $(Ho,Tb)Fe_2$; critical scattering from Gd and Er; field dependence of magnon energies in Dy and Gd.

HOLIFIELD NATIONAL LABORATORY
Solid State Division -02- (Continued)

79. NEUTRON SPECTROMETRY $420,000 02-01
H. B. Smith, W. Kamitakahara, R. M. Nicklow, H. A. Mook, N. Wakabayashi

Inelastic neutron scattering from magnetic and nonmagnetic systems; soft modes and critical scattering near phase transitions in $RbCaF_3$ and Gd; phonon dispersion curves of high temperature superconductors Nb(Zr), Hg, Tc and Mo_xRe_{1-x}; quasielastic scattering and coherent inelastic scattering from metal hydrides PdD_x. Ta(H) and Nb(H); phonon density of states and magnetic excitations of amorphous materials Co_4P, Ge and As_2Se_3; interactions in rare-earth-iron compounds; lattice dynamics of layered and molecular compounds PbI_2, I_2 and NH_4ClO_4; lattice conductor TTF-TCNQ; crystal field levels in $Sm_{1-x}Y_xS$, TmN, SmN and Nd; phonon measurements in disordered alloys, lattice dynamics and radiation damage in Cu.

80. SMALL ANGLE NEUTRON SCATTERING $110,000 02-01
H. A. Mook, D. K. Christen

Development of small angle neutron scattering instrumentation and techniques; void distribution in irradiated Al and stainless steels; systematic studies of fluxoid lattices and fluxoid pinning in Type II superconductors; pore size distributions in carbons and coal; precipitation hardening of alloys; critical fluctuations in ferromagnets EuO and Gd.

81. SUPERCONDUCTIVITY $300,000 02-02
S. T. Sekula, H. R. Kerchner, D. K. Christen, H. G. Smith

Investigations of fluxoid morphology, fluxoid dynamics, and fluxoid-defect interactions in Nb- and V-base type-II superconducting alloys and A-15 compounds by magnetization and flux-creep studies; low-frequency magnetic permeability measurements and neutron small-angle scattering by fluxoids; radiation effects in type-II superconductors; neutron inelastic scattering studies of high-transition-temperature materials.

HOLIFIELD NATIONAL LABORATORY
Solid State Division -02- (Continued)

82. RESEARCH AND DEVELOPMENT ON PURE MATERIALS — $624,000 — 02-02
J. W. Cleland, G. C. Battle, W. E. Brundage, T. F. Connolly, R. E. Reed, C. C. Robinson U. Roy, R. D. Westbrook

Initial purification, single crystal growth, and characterization of research quality materials; availability and physical properties of research quality materials via the Research Materials Information Center; arc-fusion growth of pure and doped MgO, CaO, BaO, and SrO; Czochralski growth of Ge(Li) and Ge(HP) radiation detector crystals; electron beam float zone growth of single crystals of refractory metals V, Nb, Zr, Ir, and Re and their alloys; preparation of high purity Fe-Cr-Ni alloys; preparation of Nb, V, and Mo base alloys; growth of isotopic ^{58}Ni single crystals; grain growth of large single crystals of rare earth metals and rare earth alloys; Bridgman growth of large single crystal ferrites; Czochralski growth of single crystals of A-15 type superconducting compounds such as V_3Si, Nb_3Sn, and Nb_3Ga; Bridgman growth of large single crystal fluoride perovskites such as $KMgF_3$ and $RbCaF_3$.

83. SURFACE STUDIES ON METALS — $260,000 — 02-02
L. H. Jenkins, D. M. Zehner, J. R. Noonan, J. F. Wendelken

Low energy ion damage to metal surfaces; sputtering of metals by high energy neutrons; studies of reordered metal surfaces using low energy electron diffraction (LEED) and positive ion channeling spectroscopy; LEED and Auger electron spectroscopy from "d" and "f" electron band solids; quasi-atomic structure and angular emission dependence in Auger spectra; secondary electron energy loss spectra related to crystallographic effects; thin oxide and sulfide overlayers on metal substrates; solid state aspects of heterogeneous catalysis; appearance potential spectrometry.

HOLIFIELD NATIONAL LABORATORY
Solid State Division -02- (Continued)

84. OPTICAL PROPERTIES OF MATERIALS FOR ADVANCED ENERGY SYSTEMS — $270,000 — 02-02
J. B. Bates, E. Sonder
F. A. Modine, L. C. Templeton

Effects of particle and ionizing radiation, high temperature, and impurities on the optical properties of crystalline and polycrystalline insulators, such as CaO, MgO, SiO_2 and halide perovskites; techniques include Raman scattering, laser-excited optical emission, polarization modulation spectroscopy and Fourier transform infrared spectroscopy; investigation of the phonons and excitons of pure materials as well as the vibrational and electronic properties of the ground and excited states of defects in materials.

85. HIGH TEMPERATURE CERAMICS — $386,000 — 02-02
M. M. Abraham, Y. Chen,
J. C. Pigg, R. A. Weeks

Electrical conductivity of refractory oxides SiO_2 and MgO at high temperatures, in large electric fields and in intense radiation fields; electrical, thermal, and magnetic properties of diamagnetic electrical insulators such as MgO, CeO_2 and Al_2O_3; dependence of radiation damage in MgO on specific impurities; effects of hydrogen and other ion implantation on electrical and magnetic properties; effects of 14 MeV neutron damage on MgO and CeO_2; electronic properties of transuranium elements in insulating materials.

86. PHOTOVOLTAIC AND PHOTOTHERMAL CONVERSION OF SOLAR ENERGY — $0 — 02-02
R. F. Wood, J. W. Cleland,
R. D. Westbrook, H. L. Davis

Czochralski and float zone growth of high purity and solar cell quality single crystal Si; characterization to determine the effects of point defects, defect clusters, dislocations, twins, stacking faults, and unwanted chemical impurities in Si on electrical and optical properties; thermal neutron transmutation and chemical doping experiments to increase carrier concentration in Si without degrading carrier lifetime; electrical and optical property measurements on bulk specimens and test p-n junction diodes fabricated by evaporation, diffusion, and ion implantation; study of those factors known to

HOLIFIELD NATIONAL LABORATORY
Solid State Division -02- (Continued)

86. PHOTOVOLTAIC AND PHOTOTHERMAL CONVERSION OF SOLAR ENERGY (Cont'd)

degrade conversion efficiency, such as the voltage factor, charge loss due to surface recombination, and deviations from the ideal diode curve; theoretical band structure investigations; investigations of near surface properties of materials by ion implantation and ion backscattering; preparation, characterization and investigation of promising Group IV, III-V, and II-VI semiconducting materials. To be initiated in FY 1976.

87. THEORY AND COMPUTATIONS — $570,000 — 02-03
R. F. Wood, M. T. Robinson, H. L. Davis, J. H. Barrett, J. F. Cooke, D. K. Holmes, T. Kaplan, M. E. Mostoller, O. S. Oen

Band structure calculations in metals and insulators; electronic properties of rare-earth and actinide compounds; electronic structure and optical properties of defects in insulators; high temperature oxides and carbides; reflection of light atoms from surfaces; near surface diffraction of Auger electrons; surface yield of back-scattered ions; lattice vibrations in disordered alloys; the coherent potential approximation; vibrational properties around substitutional impurities in insulators; neutron scattering from self-interstitials in fcc metals; electron screening and phonon spectra; lattice dynamics of high T_c superconductors; ferromagnetism in transition metals; spin wave calculations in Ni and Fe; Brillouin zone integration; Heisenberg spin systems; computer simulation of radiation damage; standardization of displacement dose estimation procedures; cross sections for displacing atoms in solids by fast electrons; the simulation of neutron damage by heavy ion bombardment.

88. NORMALIZATION OF ION AND NEUTRON DAMAGE — $ 80,000 — 02-04
T. S. Noggle, J. Narayan, O. S. Oen

Normalization of damage production rates using fission neutron and 5 MeV Al ion irradiation of thin films of Al; depth distribution of Cu ion damage in Cu; damage theory computations.

HOLIFIELD NATIONAL LABORATORY
Solid State Division -02- (Continued)

89. RADIATION EFFECTS IN METALS — $410,000 — 02-04
R. R. Coltman, Jr., C. E. Klabunde, J. K. Redman, J. M. Williams

Electron damage rates in V and radiation-doped Cu; interlaboratory program on damage rates in V, Nb, and Mo alloys; neutron scattering study of 4.9°K-irradiated Cu; low-temperature recovery of thermal neutron-irradiated V; radiation-enhanced diffusion in AgAu; fluxoid motion and defects in V; thermal properties of a superconducting solenoid under irradiation; correlated density and resistance measurements on copper irradiated at room temperature by fast neutrons; damage production rates in metals during ambient-temperature fast-neutron irradiation.

90. ION BOMBARDMENT — $240,000 — 02-04
B. R. Appleton, O. E. Schow, J. W. Miller

Near-surface properties of solids by ion scattering and channeling investigations on 2.5 MV positive ion accelerator; hyperchanneling studies in Au and Ag single crystals of 0.3 to 2.0 MeV H and He, and of 18-40 MeV O and I ions; stopping powers, charge exchange, and radiative electron capture as a function of charge state for 18-40 MeV O ions in Au and Ag single crystal channels; simulation and investigation of impurity ion interactions in plasmas by heavy ion channeling; determination of charge states of heavy ions within solids by characteristic x-ray yield measurements of O and Ar ions in gasses and solids; radiation damage studies of gasses implanted in metals; energy and yield measurements of electrons ejected by heavy ions transmitted through thin foils and/or single crystals.

91. X-RAY DIFFRACTION AND ELECTRON MICROSCOPY — $270,000 — 02-04
T. S. Noggle, S. M. Ohr, B. C. Larson, J. B. Roberto, J. Narayan, F. A. Sherrill

Radiation damage in nearly perfect Cu and Nb crystals; anomalous x-ray transmission; x-ray diffuse scattering; high precision measurement of lattice parameter change; transmission electron microscopy; ion damage; dislocation channeling; single crystal films; anisotropic elasticity theory of dislocation loops; theory of interaction of electrons and x-rays with defects in solids.

HOLIFIELD NATIONAL LABORATORY
Chemistry Division -03-
O. L. Keller - Phone: 483-6444

92. NEUTRON AND X-RAY DIFFRACTION - STRUCTURAL CHEMISTRY — $374,000 — 03-01
W. R. Busing, G. M. Brown, C. K. Johnson, H. A. Levy, W. E. Thiessen

Neutron diffraction crystal structure studies emphasizing light atom position determination (including hydrogen) in the presence of heavy atoms and the precise determination of thermal motion parameters; complementary x-ray diffraction work, especially on small crystals; development of techniques and computer programs for direct methods for the solution of the phase problem in crystal structure analysis; computational modeling of crystal structures from atom-atom potential functions; use of combinatorial group theory in analyzing molecular rearrangements studied by neutron diffraction.

93. NEUTRON AND X-RAY DIFFRACTION - STRUCTURAL CHEMISTRY OF LIQUIDS AND AMORPHOUS SOLIDS — $ 96,000 — 03-01
A. H. Narten

Experimental determination of the structures of liquid metals, molten salts, molecular liquids, aqueous solutions, and amorphous solids using neutron and x-ray diffraction; formulation of methods for prediction and extrapolation of properties of liquids and amorphous solids on basis of (a) determination of atomic and molecular arrangements by neutron and x-ray diffraction, (b) development and application of methods of obtaining intermolecular forces consistent with observed arrangements, and (c) application of intermolecular forces to compute, predict, and extrapolate physical properties.

94. BASIC MATERIALS CHEMISTRY RELATED TO FUSION REACTOR SYSTEMS — $405,000 — 03-02
J. T. Bell, F. J. Smith, J. D. Redman, G. M. Begun

Studies are being made of tritium permeation through alloys proposed as construction materials as well as the determination of surface oxidation effects in impeding permeation; the chemistry of the oxide build-up is also being investigated along with the effects of temperature cycling on the film; basic chemical information is being obtained on the behavior of tritium in molten metals and salts proposed as CTR blankets; molten Li and Li_2BeF_4 and alternate blanket materials (e.g., Li-Al alloy).

HOLIFIELD NATIONAL LABORATORY
Chemistry Division -03- (Continued)

95. THERMODYNAMICS AND TRANSPORT IN MOLTEN SALTS AND HYDROUS MELTS — $115,000 — 03-03
J. Braunstein, A. L. Bacarella

Characterization of transport properties in anhydrous and hydrous molten salts is being carried out to develop models applicable to very concentrated aqueous electrolytes and molten glass forming systems such as beryllium fluoride-alkali fluoride mixtures; the methods of irreversible thermodynamics are used to derive equations applicable for data analysis; experimental methods include chronopotentiometry, potentiometry, and isopiestic equilibration; diffusion, conductance, and transference parameters are obtained of interest in ionic systems including high temperature batteries.

96. SURFACE CHEMISTRY — $ 98,000 — 03-03
G. P. Smith, E. L. Fuller,
P. A. Agron

Classical surface chemistry applied to adsorption processes on catalysts and refractory oxides from 77°K to 1000°C; porosity of coal and catalysts; calorimetric measurements of adsorption from 25 to 200°C; infrared spectra of adsorbed species to 800°C.

97. ELECTROCHEMICAL KINETICS AND CORROSION — $132,000 — 03-03
F. A. Posey, H. R. Bronstein,
E. J. Kelly

Basic electrochemical mechanisms of corrosion reactions applicable to localized attack of metals (e.g., titanium) needed for understanding corrosion in active and passive states and effects of restrictive geometries (such as pitting, crevice corrosion, and stress corrosion cracking); magnetoelectrochemical studies related to CTR; properties of electrode systems designed with attention to both electrochemical and hydrodynamic properties (porous, capillary and channel electrodes, suspension electrodes, etc.); applications of such systems to analysis or electrolytic treatment of flowing streams.

HOLIFIELD NATIONAL LABORATORY
Chemical Technology Division -03-
D. E. Ferguson - Phone: 483-6051

98. CHEMICAL ENGINEERING RESEARCH — $130,000 — 03-02
C. D. Scott, W. W. Pitt,
R. M. Canon

New methods for preparing materials and carry out processing; adiabatic burning of HTGR fuels, hydraulic cyclones for solid-liquid separations; preparation of small beads of sorption media for high resolution chromatography.

99. PREPARATION AND PROPERTIES OF ACTINIDE CARBIDES AND NITRIDES — $120,000 — 03-02
A. P. Malinauskas, T. B. Lindemer,
E. C. Beahm

Properties and reactions of the ceramic carbides, oxides and nitrides of the actinides and lanthanides; studies of the U-N-(Cr, Fe, Ni) system including prediction of stability ranges of compounds of type $U(Cr, Fe, Ni)_2$; computational methods for free energy functions for actinide carbides and nitrides.

ILLINOIS, UNIVERSITY OF
Urbana, Illinois 61801
Materials Research Laboratory
R. J. Maurer - Phone: Area Code 217 - 333-1370

100. ELECTRONIC STRUCTURE AND MAGNETISM OF TRANSITION METAL ALLOYS — $ 64,000 — 01-01
P. A. Beck

Magnetic properties of alloys of the 3d transition metals; magnetic structure of mictomagnetic spin glass alloys; Au_4V, Fe_3Al and Cu-Mn alloys; measurements of magnetic susceptibility and specific heat.

101. SOLID STATE PHASE TRANSFORMATIONS AND THIN FILMS — $ 98,000 — 01-01
C. M. Wayman

Martensitic phase transformations and pretransformation lattice instabilities in bulk material and thin films; shape memory effect for conversion of heat to work; mechanism of hydride formation for energy storage; major technique is electron microscopy.

102. DYNAMIC STRUCTURE OF SUPERCRITICAL DENSE WATER AND AQUEOUS ELECTROLYTE SOLUTIONS — $ 28,000 — 01-01
J. Jonas, H. Drickamer

Transport properties of electrolytes in superheated high pressure steam for separation of uranium isotopes; properties of water at high temperature and pressures studied by nuclear magnetic resonance.

103. POINT DEFECT - DISLOCATION INTERACTIONS — $137,000 — 01-02
H. Birnbaum

Study of the diffusion mechanism and trapping of hydrogen and deuterium in bcc metals; anelastic, magnetic relaxation and Raman techniques are used.

104. THE MECHANISM OF STRESS-CORROSION CRACKING: PROPAGATION STUDIES — $ 59,000 — 01-02
E. N. Pugh

Determination of the stress corrosion cracking mechanism and crack propagation in Mg, Al, Zn and Ti alloys in aqueous solutions and gases; emphasis is on fractographic and acoustic emission studies.

ILLINOIS, UNIVERSITY OF
Materials Research Laboratory (Continued)

105. DEFORMATION OF REINFORCED METALS — $ 40,000 — 01-02
M. Metzger

Examination of the role of dislocations in determining the mechanical properties of metal composite materials with Ni_3Al-Ni_3Nb aligned eutectic alloy as a model substance; microstrain measurements and electron microscopic techniques are used.

106. DEFORMATION OF INTERMETALLIC COMPOUNDS AT ELEVATED TEMPERATURES — $ 45,000 — 01-02
H. Fraser

Determination of the mechanism of the high temperature plastic deformation of hard metals, like NiAl; study of hydride precipitation, hydrogen embrittlement and fracture of Nb-H alloys; deformation studies are carried out inside the electron microscope.

107. PRECIPITATION IN REFRACTORY METAL ALLOYS — $ 29,000 — 01-02
C. Wert

Study of the metallurgical properties of alloys of V, Nb, and Ta with the interstitial solutes hydrogen and carbon; electron microscopy and thermodynamic techniques are used.

108. INTERSTITIAL SOLID SOLUTIONS — $ 57,000 — 01-03
C. Alstetter

Study of the mechanical properties of the bcc metals V, Nb, Ta containing oxygen and nitrogen with emphasis on strengthening effect of precipitates; examination of the effects of solutes and precipitates on sputtering by ions; techniques include electron microscopy, tensile tests and emf of solid electrolyte cells.

109. NUCLEAR MAGNETIC RESONANCE STUDIES — $ 63,000 — 01-03
T. Rowland

Measurement of the diffusivity of hydrogen in niobium and effects of oxygen and nitrogen by nuclear magnetic resonance; study of molecular segmental motion in cross linked polymers by nuclear magnetic resonance.

ILLINOIS, UNIVERSITY OF
Materials Research Laboratory (Continued)

110. USE OF VERY HIGH PRESSURE TO INVESTIGATE THE STRUCTURE OF MATTER — $121,000 — 02-02
H. G. Drickamer

Investigation of electronic energy levels and wave functions of alkali halides, phosphors, spiropyrans, anils and titanates through optical absorption and luminescence with very high pressure as a primary tool.

111. ANHARMONIC EFFECTS IN SOLIDS — $102,000 — 02-02
A. V. Granato

Study of the elastic properties and strength of normal and superconducting metals by ultrasonic techniques; determination of the configuration of the hydrogen interstitial in metals.

112. DEFECT AND ELECTRONIC PROPERTIES OF SOLIDS — $102,000 — 02-02
D. Lazarus

Studies of transport phenomena both ionic and electronic in metals and salts as functions of temperature and pressure; self-diffusion in titanium; conductivity, tracer diffusion and noise measurements on the superionic silver iodides.

113. DIELECTRIC SOLIDS — $0 — 02-02
D. Payne

Hydrothermal growth of highly polarizable acentric crystals like Bi_2WO_6 and $Ba_2TiSi_2O_8$ and characterization of dielectric response of single and polycrystalline specimens to determine properties useful for energy and information storage, thermal detection and electronic uses. To be initiated in FY 1976.

114. PROPERTIES OF NOBLE GAS CRYSTALS — $101,000 — 02-02
R. O. Simmons

Study of the defect structure and lattice dynamics of the quantum crystals of helium, argon, krypton and methane by x-ray, Raman and dilatometric techniques.

ILLINOIS, UNIVERSITY OF
Materials Research Laboratory (Continued)

115. NUCLEAR MAGNETIC RESONANCE IN SOLIDS $134,000 02-02
C. P. Slichter

Study by nuclear magnetic resonance of (a) the Kondo effect and electronic structure of magnetic atoms, (b) charge density waves and hydrogen in transition metal chalcogenide two dimensional layer crystals; determination of the electrical conductivity of highly anisotropic one dimensional organic crystals.

116. PHYSICS OF REFRACTORY MATERIALS $100,000 02-02
W. S. Williams

Characterization of the thermal, mechanical and electronic properties of the transition metal carbides and the biological ceramic materials bone and teeth; techniques include x-ray topography, high temperature compression tests, electrical measurements and theoretical calculations.

117. RADIATION DAMAGE IN SOLIDS $150,000 02-04
J. S. Koehler

Determination of the geometrical structure, migration and formation energy of defects produced in metals by high energy electrons; study of void formation during high temperature irradiation; measurement of electrical resistance, anomalous transmission of x-rays, high temperature dilatometry and theoretical studies are major techniques.

LAWRENCE BERKELEY LABORATORY
University of California
Berkeley, California 94720
Phone: Area Code 415 843-2740

Inorganic Materials Research Division
V. Zackay - Phone: 642-3812
R. Muller - Phone: 843-6079

118. POWDER METALLURGY $180,000 01-01
M. R. Pickus

Liquid phase sintering applied to the iron carbon system; control of the micro and macro structural characteristics of rare-earth iron Laves phases prepared by powder metallurgy techniques; dispersion of rounded particles of titanium carbide in a Type 410 stainless steel for resistance to abrasion in corrosive environments.

119. MICROSTRUCTURE, PROPERTIES AND ALLOY DESIGN: ELECTRON DIFFRACTION AND MICROSCOPY $220,000 01-01
G. Thomas

Experimental structural steels having superior tensile and toughness properties and which can be obtained as economically as possible; thus mechanical processing is presently excluded from processing sequences; studies are being carried out on the microstructures and phase transformations in certain ferrites and minerals and on non-stoichiometric TaC; with the acquisition of two new high resolution electron microscopes capable of 2Å Fourier line resolution (Philips EM 301 - 100 kV and Siemens Elmiskop 102 - 125 kV) we are now in a position to make more detailed studies of substructure, especially early stages of phase transformations, than was hitherto possible.

120. FUNDAMENTALS OF ALLOY DESIGN $725,000 01-02
V. F. Zackay, E. R. Parker

Principles of the quantitative design of alloys; because of the complexity and size of this task, we have confined our research to certain aspects of the overall problem; these research focal points have been: (1) the elucidation of the detailed relationship between structure (defect, crystal and microstructure) and mechanical properties (strength, ductility and fracture toughness), and (2) the formulation and implementation of a long range program to study the thermodynamics, kinetics, and alloy theory of complex systems; almost all of the work has been on ferrous systems.

LAWRENCE BERKELEY LABORATORY
Inorganic Materials Research Division (Continued)

121. CRYSTAL IMPERFECTIONS IN DAMAGED, ION IMPLANTED AND SOLID STATE ELECTRONIC MATERIALS — $180,000 — 01-02
J. Washburn

Using a hot stage in the 650kV electron microscope it has been possible to directly and continuously observe the climb of dislocations as they preferentially capture interstitial atoms; the shape memory effect in NiTi has been shown by direct electron microscope observations to be associated with migration of the accommodation twin boundaries within the martensite plates of the low temperature orthorhombic phase; up to about 6% strain no slip takes place and the transformation back to the CsCl high temperature phase is accompanied by 100% strain recovery; the nature of rod shaped defects and small dislocation loops in ion implanted silicon has been studied by application of weak beam diffraction contrast observation and by repeated observation of the same field of view during interrupted annealing treatments and during irradiation in the 650kV electron microscope; computer simulation of field ion microscope imaged of tips containing dislocation loops of the order of 30 Å in size and within about one loop diameter of the surface have shown that it should be possible to distinguish between loops of interstitial and vacancy type.

122. THERMODYNAMICS, PHASE STABILITY AND MECHANICAL PROPERTIES — $150,000 — 01-02
J. W. Morris, Jr.

The overall objective of this research program is to advance the theory of alloy design; the problem of designing an engineering alloy may be subdivided into four parts: (1) estimation of the thermodynamic properties of an alloy of given composition; (2) prediction of the microstructure resulting from a specified treatment of an alloy of given thermodynamic and kinetic properties; (3) prediction of the engineering properties of an alloy of given microstructure; (4) synthesis of this information in the selection of alloy composition and processing.

LAWRENCE BERKELEY LABORATORY
Inorganic Materials Research Division (Continued)

123. HIGH TEMPERATURE REACTIONS $145,000 01-03
A. W. Searcy

Both theoretical and experimental studies are being conducted in three related areas: the solution thermodynamics of phases of very narrow composition limits, the kinetics (and thermodynamics) of vaporization and endothermic decomposition reactions, and the kinetics of transport of gases and vapors through porous solids; during the present year this group is participating in a mass spectrometer study of the kinetics of extinction of flames and a study of poisonous decomposition products of flame pyrolysis.

124. SUPERCONDUCTIVITY EFFECTS - HIGH FIELD SUPERCONDUCTIVITY $180,000 01-03
M. R. Pickus

The present objective of the high field superconductivity program is the development of procedures for making multifilamentary wire; success has been achieved in modifying, toward this end, the process developed for producing a multifilamentary tape; in place of powder rolling, which results in a tape, two procedures, pressureless sintering and isostatic compaction, have been used to prepare a porous niobium matrix in cylindrical form; after infiltration with tin, the cylinders may be subjected to any of several axially symmetric deformation processes to produce a multifilamentary wire; the superconducting properties of this type of wire are now being evaluated; also new approach based on the use of precompounded powder.

125. RELATION OF MICROSTRUCTURE TO PROPERTIES IN CERAMICS $135,000 01-03
R. M. Fulrath

This program emphasizes the importance of processing in developing specific properties in ceramic materials used for structural, piezoelectric, ferroelectric, ferromagnetic, and nuclear applications; hot stage scanning electron microscopy is used to study sintering of ceramic and metal powder compacts to develop better theories of powder compact densification behavior; composition and processing control are used to develop specific defect structures in piezoelectric and ferroelectric ceramics in the lead zirconate titanate system; strength relations to microstructure developed in processing are determined.

LAWRENCE BERKELEY LABORATORY
Inorganic Materials Research Division (Continued)

126. COMPOSITE MATERIALS AND THEIR ELECTRICAL MAGNETIC AND MECHANICAL PROPERTIES — $100,000 — 01-03
R. H. Bragg

Studies of glassy carbon; kinetic data, believed to be the first, of the unit cell dimensions, electrical resistivity, Hall effect and magnetoresistance of heated treated Glassy Carbon were obtained; the properties of hard carbons follow a characteristic (T,t) trajectory during heat treatment; this should enable prediction of processing conditions necessary to achieve pre-selected physical properties of hard carbons; the work on the electrical properties of directionally solidified Al-Cu eutectic showed that the simple rule of mixtures is not reliable as a formula for predicting the electrical properties of IN SITU composites even if separately measured values of the component properties are used.

127. MICROSTRUCTURE AND MECHANICAL BEHAVIOR OF CERAMIC MATERIALS: GLASS- AND CERAMIC-METAL SYSTEMS — $150,000 — 01-03
J. A. Pask

A thermodynamic analysis indicates that the change in grain boundary energy has to be taken into account as well as the change in surface energy in determining the driving force for sintering of a single phase material and that the motivation for mass transport is the increase of the dihedral angle formed at grain-grain-vapor contacts toward its equilibrium value; it has been shown that atmospheric corrosion enhances sintering by maintaining a small dihedral angle, e.g., sintering magnesia powder in a flowing water vapor atmosphere; the stress-strain behavior of polycrystalline magnesia specimens fabricated by hot pressing was shown to be dependent primarily on the character of the grain boundaries as affected by the powder preparation procedures, the nature of the die, and the ambient atmosphere during subsequent annealing.

LAWRENCE BERKELEY LABORATORY
Inorganic Materials Research Division (Continued)

128. RESEARCH ON SUPERCONDUCTORS, SUPERCONDUCTING DEVICES, AND NOISE — $160,000 — 02-02
J. Clarke

A highly reliable dc SQUID magnetometer has been developed using Nb-NbO_x-Pb tunnel junctions; the device has a sensitivity of 10^{-10} g/$\sqrt{Hz}$ at frequencies above 1 Hz, and a long term drift of less than 2 x 10^{-10} g/hr; the magnetometer is simple to use, and has been successfully used in the Nevada desert to measure fluctuations in the earth's magnetic field; a three-axis version of the magnetometer is to be used to survey for geothermal and mineral resources; our theory of 1/f noise quantitatively explains the noise in thin metal films, superconducting films at the transition temperature, and Josephson junctions; the realization that 1/f noise is generated by a thermal mechanism has already enabled us to design SQUID magnetometers and superconducting transition edge bolometers with very low 1/v noise and drift; a new technique has enabled us to fabricate Nb-Nb tunnel junctions; these junctions are the most durable yet developed, and have great promise in device applications.

129. EXPERIMENTAL SOLID STATE PHYSICS AND QUANTUM ELECTRONICS — $165,000 — 02-02
Y. R. Shen

First quantitative measurements on transient self-focusing of light; the results enable us to have a better understanding on the dynamics of self-focusing and will be useful in the design of light-power lasers; demonstrated that resonant Raman scattering can indeed yield detailed information about phonon structure, electronic structure, and electron-phonon interaction which cannot be obtained otherwise; have succeeded in building cheap light-power N_2-lasers which can be used to pump tunable dye lasers in a great variety of experiments.

130. FAR INFRARED SPECTROSCOPY — $135,000 — 02-02
P. L. Richards

The far infrared cosmic background radiation has been measured and shown to fit a 2.8 K black body curve; this measurement provides strong support for "Big Bang" cosmology and limits to a few percent any drift in the value of Planck's constant during 99.9% of the life of the universe; the ground state of Mn^{3+} in Al_2O_3 has been measured and interpreted quantitatively; shallow donors and acceptors in ultrapure germanium have been identified down to concentrations of 1 part in 10^{16}.

LAWRENCE BERKELEY LABORATORY
Inorganic Materials Research Division (Continued)

131. THEORETICAL SOLID STATE PHYSICS — $ 35,000 — 02-03
M. L. Cohen

Research is centered around the electronic structure of solids; the empirical pseudopotential method (EPM) was extended and used to calculate the electronic properties of a variety of materials; bulk properties, surface states, properties of amorphous materials, chain, layer, ternary and narrow-gap semiconductors, metals, superconductivity, dielectric functions, and lattice vibrations were characteristic subjects of investigation.

132. LOW-TEMPERATURE PROPERTIES OF MATERIALS — $ 95,000 — 03-01
N. E. Phillips

Analysis of the heat capacity data on α-uranium at zero pressure has shown that bulk superconducting transitions do occur, although at lower temperatures than indicated by magnetic measurements; the transitions are broadened and raised in temperature by strains in polycrystalline samples but probably occurs near or slightly below 0.1K in a perfect crystal; the results show that the strong pressure dependence of T_c is not associated with pressure dependent spin localization and are consistent with a BCS mechanism; heat capacity data on (LaCe) Al_2 has shown the occurrence of two second order transitions corresponding to T_{c1} and T_{c2}--the transitions into and out of the superconducting state with decreasing temperature.

133. HIGH PRESSURE CHEMISTRY — $ 35,000 — 03-01
G. Jura

Determination of the electrical, magnetic, and energetic changes in a solid that are associated with the change in volume of the metal; the volume changes are obtained by the use of high pressures; also, the influence of pressure on the infrared spectra of solids such as alkaline earth carbonates and dichloro and tetrachlorobenzene are studied.

LAWRENCE BERKELEY LABORATORY
Inorganic Materials Research Division (Continued)

134. MASS AND CHARGE TRANSPORT IN ELECTROCHEMICAL SYSTEMS. PROPERTIES OF NONAQUEOUS IONIZING SYSTEMS — $ 90,000 — 03-01
C. W. Tobias

Generalized correlation of limiting rates of electrolysis measured in semi-industrial scale apparatus allows accurate prediction of energy requirements and of distribution of current in channel-flow type electrode configuration; a computer implemented procedure has been devised for the simulation of progressive growth or recession of metallic surface profiles upon electrolytic deposition of dissolution; gram quantities of potassium metal have been reduced at ambient temperature from solutions of KPF_6 and $KALCl_4$ in propylene carbonate.

135. CRYSTALLIZATION KINETICS — $ 80,000 — 03-03
L. F. Donaghey

Computer simulation studies of physical sputtering show a significant dependence of yield and angular variation of sputtered atoms on the interatomic potential function describing the interaction between target atoms and light sputtering ions; thus, experimental yield data can be used to predict repulsive potentials; the vaporization and reactive etching rates have been determined for (100) GaAs, the surface orientation most useful for commercial preparation of photovoltaic and electroluminescence devices.

136. HIGH TEMPERATURE THERMODYNAMICS — $ 60,000 — 03-03
L. Brewer

Theoretical and experimental thermodynamic studies directed toward the characterization of the high temperature behavior of all types of materials but with particular attention to the transition metals and their metallic alloys; models have been developed for the prediction of the high temperature thermodynamic properties of metals and their alloys; these models are being tested experimentally and are being applied to problems of development of new types of materials.

LAWRENCE BERKELEY LABORATORY
Inorganic Materials Research Division (Continued)

137. NUCLEAR MAGNETIC RESONANCE IN ORDERED MATERIALS — $ 70,000 — 03-03
A. Pines

Magnetic shielding of rare nuclear isotopes; new techniques for nmr of ordered materials; study of microscopic structure in solids, liquid crystals and adsorbed phases; modes of molecular reorientational motion and translational diffusion in ordered materials; nuclear spin dynamics and decoupling in solids; magnetic effects on reactions.

138. CHEMICAL PROBLEMS IN NUCLEAR TECHNOLOGY — $ 95,000 — 03-03
D. Olander

An important achievement has been the determination, for the first time, of the true nature of the primary products of the heterogeneous reaction between hydrogen and graphite; the observation of the emission of the radicals CH and CH_2 from a heated graphite surface bombarded by atomic hydrogen was possible only in a kinetic study utilizing molecular beam methods; in addition, our theoretical work has shown that the redistribution of the heavy metals U and Pu in the steep temperature gradient of a fast reactor fuel pin cannot be ascribed to the commonly accepted mechanism of vapor transport by pore migration; other theoretical studies on the centrifuge method of separating uranium isotopes have revealed potentially more efficient methods of cascade design than those which have been employed up to now.

139. ELECTROCHEMISTRY, SOLID-FLUID PHASE BOUNDARIES — $135,000 — 03-03
R. H. Muller

Local reaction rates on extended electrodes have been determined by interferometry in a systematic study of electrochemical mass transport boundary layers under conditions of forced convection; for the first time, effects of light-deflection in the liquid and reflection from the electrode have been taken into account in the interpretation of interferograms; the scope of ellipsometry as a tool for in situ observation of surface layers has been expanded to include the measurement of mass transfer boundary layers, that have been neglected in ellipsometry so far.

LAWRENCE BERKELEY LABORATORY
Inorganic Materials Research Division (Continued)

140. SOLID STATE AND SURFACE REACTION STUDIES — $180,000 — 03-03
G. A. Somorjai

Hydrogen-deuterium exchange reaction on a series of low and high Miller Index platinum single crystals; low energy electron diffraction studies of the adsorption of ammonia on the iron (110) crystal face showed that during the dissociation adsorption of the molecule the ordered iron surface becomes completely disordered; the effect of gold on the reactivity of platinum surfaces has been studied; naphthalene and ice single crystals with well-ordered surfaces were grown successfully in the low energy electron diffraction chamber; a new rapid and accurate photographic method has been developed for the measurement of LEED beam intensities; thorium single crystals have been successfully cleaved and studied by LEED and electron spectroscopy.

LOS ALAMOS SCIENTIFIC LABORATORY
University of California
P. O. Box 1663
Los Alamos, New Mexico 87544
Phone: Area Code 505 667-5061

CMB Division
R. D. Baker - Phone: 667-4563
M. G. Bowman - Phone: 667-6014

141. HIGH TEMPERATURE MATERIALS FOR ENERGY APPLICATIONS — $180,000 — 01-02
E. K. Storms, S. R. Skaggs

Thermal stability of possible coating materials; boron activity in various transition metal boride systems determined by high temperature mass spectrometry; data used to obtain phase relationships, thermodynamic properties and bond energies; diffusion rates of carbon and boron through coatings of various carbides and borides measured by mass spectrometry; data being used to interpret thermionic emission measurements and develop a bonding theory based on the Fermi energy.

142. HIGH TEMPERATURE NEUTRON DAMAGE STUDIES — $175,000 — 01-04
W. V. Green, D. M. Parkin, W. F. Sommer, M. L. Simmons

The accelerator LAMPF, its beam stop used as a neutron source; spallation evaporation neutrons; elastic and nonelastic primary recoils computed from nuclear data - cross sections and thresholds; fast fission, fission and LAMPF spectra effects; radiation damage parameters; physical measurements to verify or deny calculations; radiation hardening; electrical resistivity; electron transmission microscopy; internal friction; radiation creep; instrumented and controlled experiments in LAMPF.

LOS ALAMOS SCIENTIFIC LABORATORY
CMB Division (Continued)

143. CTR RELATED CHEMICAL RESEARCH - TRITIUM CHEMISTRY ASSOCIATED WITH THE LITHIUM BLANKET AND CONTAINER MATERIALS — $130,000 — 03-02
J. L. Anderson, R. M. Alire, D.H.W. Carstens

Simultaneous measurement of diffusion coefficient and solubility of H_2 in Li and its containers Nb and Nb-1%Zr; development of a diffusion model based on the combined radial and axial diffusion of H_2 into a solid cylinder to determine the solubilities and diffusion coefficients and testing of model by least-squares fitting of experimental data to the model; preliminary studies cover temperature range 1073 - 1373 K and pressure range 0.13 to 1330 Pa; extraction of tritium from molten Li using low melting eutectics containing Y, La and Ce; early emphasis on 84 a/o La-16 a/o Ni (mp $\sim$783 K) eutectic; temperature coefficient for the liquid-liquid extraction and Pressure-Composition-Temperature diagram for the appropriate metal-hydrogen systems under investigation; other eutectics under investigation include 84 a/o Ce-16 a/o Co, 82 a/o Ce-18 a/o Ni, 88 a/o Ce-12 a/o Fe, and 69 a/o Y-31 a/o Co.

MOUND LABORATORY
Monsanto Research Corporation
P. O. Box 32
Miamisburg, Ohio 45342
L. J. Wittenberg - Phone: Area Code 513 866-7444 x3571

144. LIQUID ACTINIDE METALS RESEARCH $110,000 01-03
L. J. Wittenberg, C. R. Hudgens

Viscosity studies of liquid actinide metals, U, Th; applicability of hard sphere model to describe the physical properties of alkali halide fused salts; electrotransport of tritium in liquid Li; structural studies of liquid Hg with theta-theta x-ray diffractometer.

PACIFIC NORTHWEST LABORATORY
P. O. Box 999
Richland, Washington 99352
Phone: Area Code 509 942-7411

145. TRANSURANIUM CERAMICS RESEARCH — $ 90,000 — 01-01
T. D. Chikalla, R. P. Turcotte

Thermochemical and structural behavior in transuranium oxides; self irradiation damage in PuO_2; use of alpha emitters to study radiation damage and gas implantation; $^{249}CfO_x$; $^{249}(Bk, Cf)O_x$; $^{239}PuO_2$; $^{244}CmO_x$; x-ray diffraction; helium release studies.

146. TRANSURANIUM PHYSICAL METALLURGY — $210,000 — 01-03
R. D. Nelson, S. D. Dahlgren,
M. D. Merz, R. P. Allen

Phase transformations in Pu; deformation processes in fine grained alpha Pu, coarse grained alpha Pu and sputter deposited Pu; creep of Pu allotropes; physical metallurgy of Np; self irradiation damage in Pu and Np metal.

147. SPUTTER-DEPOSITED SUPERCONDUCTOR RESEARCH — $100,000 — 01-03
R. D. Nelson, S. D. Dahlgren

Study of sputter-deposited superconductors; cathodic sputtering; synthesis of new superconducting materials; relation of sputter-deposition parameters to properties; structure and stability of sputter deposits; high-field A-15 compounds; Nb_3Al, $Nb_3(Al-Ge)$, Nb_3Ge, Nb_3Sn, Nb_3Gd, Nb_3Si.

148. RADIATION EFFECTS ON METALS — $325,000 — 01-04
J. L. Brimhall, H. E. Kissinger,
E. Simonen

Production, migration and annihilation or coalescence of irradiation produced defects; effect of helium on void nucleation in Mo and V; theoretical analysis of void coarsening behavior and void surface kinetics; analysis of Stage III annealing behavior in irradiated Mo; comparison of 14 MeV neutron damage to fission neutron damage; role of substructure in high temperature ion irradiation damage.

SECTION B

Universities

The information was taken from current 200-Word Summaries provided by the contractor. There is considerable (about 10%) turnover in the University program and some of the projects will be not continued beyond the current contract period.

ARIZONA STATE UNIVERSITY

201. SOLID STATE CHEMISTRY OF RARE EARTH OXIDES — $ 95,000 — 03-01
L. Eyring - Dept. of Chemistry

The structure of rare earth oxides, with emphasis on the role of defects imposed on the solid through chemical change; x-ray and neutron diffraction, and especially high resolution electron optical methods for the structural analysis of oxide phases of narrow composition range; study of order-disorder transformations to yield wide-range nonstoichiometric phases having compositions $R_nO_{2n-2}(4 < n < \infty)$.

202. STUDY OF FERRITE FORMATION IN NEUTRON IRRADIATED AUSTENITIC STAINLESS STEELS — $ 53,578 — 01-04
J. T. Stanley - Engineering Mechanics, Materials & Measurements Dept.

Ferrite formation in 316 and 321 stainless steel under irradiation; magnetization measurements; fluences up to 3.5×10^{22} neutrons/cm^2; proton irradiations also; electron microscopy; effects of heat treatment, temperature and composition.

BROWN UNIVERSITY

203. A COMBINED MACROSCOPIC AND MICROSCOPIC APPROACH TO THE FRACTURE OF METALS — $ 80,000 — 01-02
J. Gurland and J. R. Rice - Division of Engineering

Analytical and experimental investigations of yield and flow behavior in carbide-strengthened steels, boundary and particle effects on strengthening and crack initiation and growth, and diffusive mechanisms in high temperature creep and rupture; finite element analysis, mechanical testing, and quantitative metallography utilized.

CALIFORNIA INSTITUTE OF TECHNOLOGY

204. STUDIES OF ALLOY STRUCTURES AND PROPERTIES — $178,025 — 01-01
P. Duwez - Division of Engineering

Structure and properties of metastable alloys obtained by quenching from the melt; methods of preparation and properties of new superconducting alloys; study of amorhpous Cu-Pd-P alloys; magnetic susceptibility; magneto-resistance; crystallization of amorphous alloys; properties of Cu-base superconductors containing V and Ga; properties of metastable superconductors in the binary systems Nb-Ir, Ta-Ir, Ta-Rh.

CALIFORNIA, UNIVERSITY OF

205. HIGH TEMPERATURE IRRADIATION DAMAGE AND PRECIPITATION HARDENING IN Ni-BASE ALLOYS — $ 69,000 — 01-02
A. J. Ardell - Materials Department, Los Angeles

Effects of solute additions on irradiation induced defect formation at elevated temperatures in Ni-base alloys; precipitation hardening in concentrated Ni-base alloys containing high volume fractions of gamma prime precipitate; irradiations with 0.4 or 2 MeV protons to doses up to 10 dpa in the temperature range 300-600°C; transmission electron microscopy; CRSS measured as a function of gamma prime particle size and test temperature for Ni-Si alloys.

206. FOURIER SPACE COMPUTER SIMULATION OF CRYSTALLINE IMPERFECTIONS — $ 35,000 — 01-01
D. de Fontaine - Materials Dept., Los Angeles

Theoretical studies in three areas using Fourier (lattice wave) methods: lattice and continuum computations of elastic energies of crystal defects, vacancy kinetics in irradiated materials, and ordering and clustering in alloys; computer algorithms developed for calculating defect-induced lattice distortions, based on continuum elasticity (force constant) representations.

207. ELECTRIC AND MAGNETIC PROPERTIES OF TRANSITION METALS AND THEIR COMPOUNDS — $ 64,982 — 02-02
A. W. Lawson and G. E. Everett - Dept. of Physics, Riverside

Investigation of higher order critical transitions between the various magnetic phases of EuSe and DySb; phase boundaries as a function of internal field and temperature; single crystal spheres; effect of uniaxial stress on the transitions; effect of N and O on the metamagnetic properties of GdN.

208. THEORETICAL ASPECTS OF SUPERCONDUCTOR BEHAVIOR — $ 77,000 — 02-03
E. Simanek - Dept. of Physics, Riverside

Theoretical study of the dynamics of the order-parameter fluctuations in superconductors in the vicinity of the transition point; interpretation of fluctuation induced Josephson current; calculations of fluctuations of order-parameter phase in charged superfluid; a new model involving order parameter-density coupling.

CALIFORNIA, UNIVERSITY OF (Continued)

209. THE RESPONSE OF SUPERCONDUCTORS TO VARIATIONS IN IMPURITY CONTENT AND APPLIED PRESSURE — $115,000 — 02-02
H. Suhl and M. B. Maple - Dept. of Physics, San Diego

Changes in superconducting properties in the presence of magnetic and nonmagnetic impurities; effect of pressure on the superconducting properties of the soft superconductors Al, Cd, Zn and the lamellar graphitic compounds; systematic study of various 3d, 4d and 5d transition metals on the superconducting properties of the A-15 compounds; Superconducting-Kondo systems with multiple transition temperatures; superconductors containing rare earth impurities with crystal-field split energy levels.

210. RESEARCH ON THE PROPERTIES OF MATERIALS AT VERY LOW TEMPERATURES — $209,987 — 02-02
J. C. Wheatley - Dept. of Physics, San Diego

Properties of superfluid ^3He at millidegree temperatures; superfluid density and static nuclear magnetism; effect of bounding geometry on the specific heat; dynamic magnetism to allow detailed study of the coherent dipolar energy; phase diagram near the polycritical point via the use of zero sound.

CARNEGIE-MELLON UNIVERSITY

211. GENERALIZATION OF INTERNAL CENTRIFUGAL ZONE GROWTH OF METAL-CERAMIC COMPOSITES — $ 33,000 — 01-01
R. F. Sekerka - Dept. of Metallurgy & Materials Science

Investigation of the internal centrifugal zone growth (ICZG) crystal growing process for refractory metals, compounds and composites; theoretical modeling of the directional solidification, crucible-less process to determine parameter sensitivity including growth rate, power input and material conductivity; experimental research to confirm models.

CASE WESTERN RESERVE UNIVERSITY

212. DISLOCATION-SOLUTE ATOM INTERACTIONS IN ALLOYS — $ 45,500 — 01-02
R. Gibala - Dept. of Metallurgy and Materials Science

Experimental study of interstitial solute effects in refractory metals, primarily Nb, at and below room temperature; effect of macroscopic gradients on yielding, solute-solute clustering and/or partitioning to defects; hydrogen embrittlement; mechanical testing; internal friction; electrical resistivity.

213. EXPERIMENTS IN HIGH VOLTAGE ELECTRON MICROSCOPY — $ 60,463 — 01-04
T. E. Mitchell - Division of Metallurgy and Materials Science

High voltage (650 kv) electron microscopy of in-situ radiation damage; effects of surfaces, temperature, electron flux, and dislocation density on void formation in Cu, Ni, V and stainless steels; radiation enhanced precipitation in Al-Cu, Al-Si alloys and stainless steels; displacement damage in SiO_2 and fluorite structure oxides.

214. ELASTIC AND PLASTIC STRAINS AND THE STRESS CORROSION CRACKING OF AUSTENITIC STAINLESS STEELS — $ 39,500 — 01-02
A. R. Troiano - Division of Metallurgy and Materials Science

Stress corrosion cracking of steels and nickel alloys in aqueous chloride environments; threshold stress, failure time, and critical potentials for cracking and pitting related to prior plastic strain (microstructural effects) and residual elastic strain (stress effects); hydrogen permeability measurements.

CHICAGO, UNIVERSITY OF

215. THE STUDY OF PHONONS AND ELECTRONIC PROCESSES IN AMORPHOUS AND CRYSTALLINE SOLIDS — $ 45,000 — 02-02
S. A. Solin - Dept. of Physics

Optical studies of the Mott Transition in the temperature range 1°-2000°K, using laser Raman (2μ) spectroscopy; the effects of uniaxial stress on electronic Raman spectra of Ge(As); Brillouin scattering experiments on opaque amorphous and crystalline solids, e.g. boron nitride; spectroscopic studies of amorphous diamond, and determination of microstructural properties of metastable low viscosity liquid state of P_2O_5 and of amorphous As_2O_3 in the bulk and in thin films.

CINCINNATI, UNIVERSITY OF

216. RADIATION EFFECTS TO BCC REFRACTORY METALS AND ALLOYS — $ 45,000 — 01-04
J. Moteff - Dept. of Materials Science & Metallurgical Engineering

Experimental investigation of radiation effects in refractory metal alloys exposed to $\sim 10^{22}$ n/cm^2(E > 1 MeV) and heavy ion irradiation; changes in microstructure, swelling, void number density and void size distribution; hardness, elevated temperature strength; Mo, Mo - 0.5 Ti, Nb, Nb-1Zr and W-25 Re.

CLARKSON COLLEGE OF TECHNOLOGY

217. NUCLEATION OF VOIDS — $ 21,708 — 01-04
J. L. Katz - Dept. of Chemical Engineering

Theory of irradiation effects in metals; primarily void nucleation and other defect precipitates such as interstitial loops; nucleating effects of stress, inert gases such as He, and gases which can undergo simultaneous chemical reaction such as dissolved atomic hydrogen combining to form molecular hydrogen.

COLORADO SCHOOL OF MINES

218. LIQUID LITHIUM CORROSION AND CORROSION-FATIGUE RESEARCH — $ 42,000 — 01-01
D. L. Olson and W. L. Bradley - Dept. of Metallurgical Engineering

Penetration and weight loss experiments under controlled conditions of lithium and ferrous compositions, stress, temperature and time; role of N and Cr in liquid lithium corrosion of ferrous alloys; grain boundary grooving of Fe and Fe-Cr alloys; rate controlling mechanisms associated with liquid lithium corrosion.

COLORADO, UNIVERSITY OF

219. CRITICAL SCATTERING OF LASER LIGHT BY BULK FLUIDS AND THIN FLUID FILMS — $ 50,575 — 02-02
R. Mockler and W. O'Sullivan - Dept. of Physics and Astrophysics

Study of the anomalous index of refraction in a critical binary mixture; studies in thin critical fluid films to determine if 2-dimensional critical behavior is manifested; intensity autocorrelation studies of light scattered from Brownian particles.

COLUMBIA UNIVERSITY

220. HIGH TEMPERATURE TRANSPORT PROPERTIES AND PROCESSES OF GASES AND ALKALI METALS — $ 32,000 — 03-02
C. F. Bonilla - Dept. of Chemical Engineering

Measurements of liquid compressibility and of vapor pressure of cesium, sodium and lithium to the critical point; studies of cavitation in sodium flow in LMFBR components.

CONNECTICUT, UNIVERSITY OF

221. ELECTRON-DISLOCATION INTERACTIONS AT LOW TEMPERATURES — $ 40,000 — 01-02
J. M. Galligan - Dept. of Metallurgy

Electron drag effects on dislocations; plastic behavior of pure metals and alloys in the vicinity of their superconducting transition temperatures; dislocation-flux line lattice interactions in Type II superconductors; Pb, Pb-Sn, Pb-Bi, Pb-In alloys and Nb.

222. CLUSTER CARBURIZING — $ 39,607 — 01-01
J. E. Morral - Dept. of Metallurgy and Institute of Materials Science

Study of the carburizing process; rate of carbon absorption by a Ta-27%Hf alloy; cluster carburizing concept.

CORNELL UNIVERSITY

223. STRUCTURE AND PROPERTIES OF GRAIN BOUNDARIES — $ 75,000 — 01-01
R. W. Balluffi - Dept. of Materials Science and Engineering

High resolution electron microscopy methods of investigating structure in specimens containing grain boundaries of controlled geometry; fine structure of high angle grain boundaries in Au; diffusion along high angle grain boundaries and along dislocations in low angle boundaries; solute atom segregation at grain boundaries; relative energies of grain boundaries.

CORNELL UNIVERSITY (Continued)

224. REDUCTION OF MIXED SPINEL OXIDE — $ 40,650 — 01-01
L. C. DeJonghe - Dept. of Materials Science and Engineering

Microstructural changes and reduction kinetics of oxide spinels by hydrogen; Fe_3O_4, $CoFe_2O_4$, and $NiFe_2O_4$; effects of MgO and Al_2O_3 substitutions; transmission electron microscopy and thermogravimetric analysis.

225. ENVIRONMENT AND FRACTURE — $ 59,000 — 01-02
H. H. Johnson - Dept. of Materials Sciences and Engineering

Hydrogen trapping in Fe; precise permeation measurements; transmission electron microscopy studies of annealed Fe to correlate trapping parameters with dislocation structure; comparative study of H and D permeation in Ni; techniques for studying H in Nb.

226. THEORY OF STRUCTURE AND DYNAMICS IN CONDENSED MATTER — $ 73,498 — 02-03
J. A. Krumhansl - Dept. of Physics, Laboratory of Atomic and Solid State Physics

Dynamics of structural phase transitions; ferroelectricity; phase instabilities in metallic alloys; structural instabilities in (pseudo) one-dimensional systems; disordered systems; engineering properties of polycrystalline and composite media; theoretical studies on disordered systems.

227. MECHANICAL BEHAVIOR OF MATERIALS AND STRUCTURAL ELEMENTS AT ELEVATED TEMPERATURES — $ 70,000 — 01-02
R. H. Lance - Dept. of Theoretical and Applied Mechanics

Mechanical equation of state incorporating a single state variable, hardness; mechanical behavior of structural elements such as beams, plates, thick- and thin-walled cylinders under typical load, histories at elevated temperature; data from simple relaxation tests on 1100 Al and stainless steel; experiments will be performed on small-scale structural members at room and elevated temperatures to establish the accuracy of analytical predictions for steady, slowly varying and rapidly varying loads.

CORNELL UNIVERSITY (Continued)

228. GRAIN BOUNDARY SLIDING AND STRUCTURE — $ 60,000 — 01-02
Che-Yu Li - Dept. of Materials Science and Engineering

Grain boundary sliding and its dependence on microstructure studied from the viewpoint of plastic equation of state; load relaxation experiments; experimental results yield constant hardness stress-strain rate relations based on which the contribution of grain boundary sliding can be evaluated; Pb, 1100 Al, 316 stainless steel.

229. EXPERIMENTAL PHONON PHYSICS — $138,009 — 02-02
R. O. Pohl and A. J. Sievers - Dept. of Physics, Laboratory of Atomic and Solid State Physics

Lattice dynamics of noncrystalline solids and of compressed and sintered materials; far infrared properties of Bi, metal particles and plastically deformed CdS; dilution refrigerator cooled bolometer detector and far infrared laser source.

230. ELASTIC AND PLASTIC DEFORMATION OF SOLIDS — $120,000 — 01-02
A. L. Ruoff - Dept. of Materials Science and Engineering

Behavior of solids at high pressures; yield strength of K as a function of pressure; first and second pressure derivatives of bulk modulus measured ultrasonically; high pressure densification of fine grain carbides; dielectric constant measurement; CsBr, NaCl, LiF.

231. DEFECTS IN METAL CRYSTALS — $160,163 — 01-04
D. N. Seidman - Dept. of Materials Science and Engineering

Field ion microscopy of crystal defects in metal crystals; properties of self-interstitial atoms; interaction of solute atoms with self-interstitial atoms; non-equilibrium segregation of solute atoms to voids; range of focusing collision sequences; migration energies; binding energies; in-situ FIM study of irradiated W; atom-probe RIM study of irradiated Mo voids; structure of displacement cascades; construction of a Poschenreider Isochronous Lens for the atom-probe FIM.

DARTMOUTH COLLEGE

232. THEORY OF ELECTRON-PHONON SCATTERING EFFECTS IN METALS — $ 22,723 — 02-03
W. E. Lawrence - Dept. of Physics and Astronomy

Diffusion model for theoretical calculations; applications to detailed studies of electrical conductivity and associated anisotropic relaxation times in the noble and polyvalent metals; extend diffusion model to thermal transport and magneto-resistivity problems; role of Fermi surface in determining the relaxation-time anisotropies; studies of the mass enhancement and superconducting gap anisotropies.

233. EXPERIMENTAL DETERMINATION OF THE TEMPERATURE DEPENDENCE OF METALLIC WORK FUNCTIONS AT LOW TEMPERATURES — $ 27,781 — 02-02
P. B. Pipes - Dept. of Physics and Astronomy

Temperature dependence of metallic work functions; effect of temperature and surface condition; Nb, Cu, Au, Ag, Al, Zn, Pb; effect of thermal gradients on superconducting materials; contribution of chemical potential and surface dipole layer to the electronic work function; absolute thermopower for non-superconducting samples.

FLORIDA, UNIVERSITY OF

234. QUANTITATIVE ANALYSIS OF SOLUTE SEGREGATION IN ALLOYS BY TRANSMISSION ELECTRON MICROSCOPY — $ 37,000 — 01-01
J. J. Hren and C. S. Hartley - Dept. of Metallurgical and Materials Engineering

Image matching methods to interpret electron microscope images of defects and defect/solute interactions; computer aided image simulation methods; numerical solutions to the anisotropic displacement fields of interacting defects; application to nucleation of precipitates in Al-Cu and Si alloys.

FLORIDA, UNIVERSITY OF (Continued)

235. DEFORMATION PROCESSES IN REFRACTORY METALS — $ 36,860 — 01-02
R. E. Reed-Hill - Dept. of Materials Science and Engineering

Deformation twinning and dynamic strain aging; kinetics of dislocation-interstitial atom reactions in prestrained niobium-oxygen alloys aged under constant stress, at temperatures near the oxygen work hardening peak; ductile-brittle-ductile fracture transition in Nb due to O; stress relaxation, tension, and return of yield point measurements; optical, scanning electron and transmission electron microscopy; internal friction to evaluate interstitial elements concentration.

GEORGETOWN UNIVERSITY

236. THE STUDY OF VERY PURE METALS AT LOW TEMPERATURES — $ 39,000 — 02-02
W. D. Gregory - Dept. of Physics

Low Temperature properties of pure single crystals; electrical conductivity, boundary scattering, superconductive tunneling, specific heat; Ge, In, Al, Zn, and TCNQ; the effects of external energy input such as optical radiation on the superconducting state.

HAWAII, UNIVERSITY OF

237. PRESSURE DERIVATIVES OF ELASTIC MODULI IN BCC TRANSITION METALS AND THEIR SOLID SOLUTIONS — $ 35,950 — 02-02
M. H. Manghnani - Dept. of Geology and Geophysics

Pressure dependence of the single crystal elastic moduli of the pure bcc transition metals, V, Nb, Ta, Cr, Mo, W; hydrostatic pressures up to 5 kbar; ultrasonic technique; lattice parameter measurements up to 100 kbar and 1000°C using diamond-anvil technique.

HAWAII, UNIVERSITY OF (Continued)

238. PHOTOELECTRIC EMISSION FROM THIN FILMS IN THE VACUUM ULTRAVIOLET REGION — $ 28,131 — 02-02
W. Pong - Dept. of Physics and Astronomy

Optical and electron emission from solid surfaces and thin films under dispersed ultraviolet excitation of photon energies 7-27 eV; measurements of quantum yield, fluorescence, and energy distributions of photoelectrons; alkali halides, lanthanum halides, SiO_2, and thin films of adenine and cytosine; effects of elevated temperature on emission from surfaces and thin films.

HOWARD UNIVERSITY

239. RADIATION DAMAGE IN OPTICALLY TRANSPARENT MATERIALS (ZIRCONS) — $ 17,196 — 02-04
A. N. Thorpe - Dept. of Physics

Effects of natural alpha particle recoil, external gamma irradiation and neutron induced fission on the visible and infrared absorption spectrum; low temperature magnetic properties; electron spin resonance, and thermoluminescence of natural and synthetic zircon crystals.

ILLINOIS INSTITUTE OF TECHNOLOGY

240. THERMAL MEASUREMENTS ON SOLIDS AT LOW TEMPERATURES — $105,000 — 02-02
H. Weinstock - Dept. of Physics

Low temperature thermal conductivity to study defects produced in deformed MgO, neutron irradiated V; Cu-Cr Kondo alloys; thermal conductivity of fast neutron irradiated CaO, Al_2O_3, Cu, Al; Pb-Tl-Li superconducting alloys; changes in H vs. J_c for Nb_3Sn irradiated at low temperatures.

KANSAS, UNIVERSITY OF

241. HIGH TEMPERATURE CHEMISTRY — $ 75,000 — 03-03
P. W. Gilles - Dept. of Chemistry

Vaporization studies on refractory binary and ternary systems of oxides and sulfides; Knudsen effusion, torsion effusion and mass spectrometric techniques; effect of the degree of saturation on the rate of vaporization of single crystals.

LEHIGH UNIVERSITY

242. PRESSURE SINTERING AND CREEP DEFORMATION - A JOINT MODELING APPROACH — $ 40,500 — 01-01
M. R. Notis - Dept. of Metallurgy and Materials Science

Correlation of the kinetics of later stages of densification by pressure sintering and creep deformation; CoO and $MgAl_2O_4$; effects of stress, temperature, microstructure, and stoichiometry; quantitative relationships via "deformation maps."

MARQUETTE UNIVERSITY

243. DEFECT STRUCTURES IN NONSTOICHIOMETRIC OXIDES — $ 39,853 — 01-01
R. N. Blumenthal - Dept. of Mechanical Engineering

Defect structure and electrical transport properties of pure and doped nonstoichiometric oxides; electrical conductivity, transference numbers, and thermogravimetric techniques; effects of temperature, oxygen pressure, dopant valence and concentration; CeO_2 doped with SrO, Y_2O_3, La_2O_3, and ThO_2.

MARYLAND, UNIVERSITY OF

244. AN INVESTIGATION OF IRRADIATION STRENGTHENING OF BCC METALS AND SOLID SOLUTIONS — $ 46,000 — 01-02
R. J. Arsenault - Dept. of Chemical Engineering

Mechanism of irradiation strengthening of BCC metals and their solid solution alloys; effect of impurity interstitials O, C, N, H on the change in effective stress due to neutron irradiation; effect of low temperature (77°K) neutron irradiations on the deformation characteristics of high purity Nb; effect of He on the dislocation kinetics in BCC metals; studies of V also.

245. ALLOY STRENGTHENING DUE TO ATOMIC ORDER — $ 19,397 — 01-02
M. J. Marcinkowski - Dept. of Mechanical Engineering

Behavior of non-coaxial elliptically shaped dislocation loops with respect to their locking and cross slip behavior; work hardening behavior of pure metals and alloys; calculations done numerically with the aid of a digital computer; effect of atomic ordering on mechanical behavior - atomic ordering gives rise to extended or coupled dislocations which greatly restricts their motion.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

246. THERMAL NEUTRON SCATTERING STUDIES OF MOLECULAR DYNAMICS AND CRITICAL PHENOMENA IN FLUIDS AND SOLIDS — $ 79,900 — 02-01
S. H. Chen and S. Yip - Dept. of Nuclear Engineering

Triple axis neutron spectrometry used to study density dependence of self diffusion in gas and gas mixtures; methane and methane in argon; coherent scattering from nitrogen to observe. Brillouin-like scattering of neutrons at high pressures; laser light scattering from Xe-He mixtures; computer simulation.

247. THE LUMINESCENCE PROCESS AND NEW AND NOVEL ELECTRONIC STATES - SCANNING CHEMICAL REACTIONS AND NOVEL PRODUCTS FOR LASER INDUCED ISOTOPE SEPARATION — $ 51,131 — 03-03
J. L. Gole - Dept. of Chemistry

Study of the formation and structure of metal aggregates and other high temperature species; laser-induced fluorescence and chemiluminescence techniques for study of electronically excited states of matter.

248. BASIC RESEARCH IN CRYSTALLINE AND NONCRYSTALLINE CERAMIC SYSTEMS — $335,000 — 01-01
W. D. Kingery and R. L. Coble - Dept. of Metallurgy and Materials Science

Band gap measurements in oxides at high temperatures; electrical conductivity of doped UO_2; irradiation enhanced sintering; transient and quasi-steady state diffusion controlled final stage sintering; microstructure effects on polycrystalline Al_2O_3 properties; ion distribution in solid-state electrolytes; self diffusion in Al_2O_3; defect equilibration kinetics in CoO; chemical transport at grain boundaries; grain boundary effects, properties, defects and solute atom distributions in MgO model system; application of optical techniques to defect interaction and ceramic processes; preparation of pure powders; high temperature transmission electron microscopy.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

249. LOW TEMPERATURE AND NEUTRON PHYSICS STUDIES — $111,274 — 02-01
C. G. Shull - Dept. of Physics

Diamagnetic scattering of polarized neutrons by crystals of Bi and Cu; spatial distribution of the diamagnetization density and de Haas-van Alphen oscillatory magnetization; phonon instabilities; coexistence of superconductivity and ferromagnetism.

MICHIGAN STATE UNIVERSITY

250. AN INVESTIGATION OF SOME LANTHANIDE CARBON, NITROGEN, CHALCOGEN, AND HALOGAN SYSTEMS AT ELEVATED TEMPERATURES — $ 28,600 — 03-03
H. A. Eick - Dept. of Chemistry

Synthesis and determination of structural parameters of lanthanide binary and ternary refractories; measurement of vapor pressures by Knudsen and mass spectrometry; correlation of structural and thermodynamic results.

251. PROPERTIES OF RARE GAS SOLIDS — $ 99,607 — 02-02
G. L. Pollack - Dept. of Physics

Thermal conductivity of solid Ar; effects of dislocations and other defects on thermal conductivity; also N_2, Kr, O_2, Xe crystals; interaction of biological materials with rare gases.

MICHIGAN TECHNOLOGICAL UNIVERSITY

252. A STUDY OF GRAIN BOUNDARY SEGREGATION USING THE AUGER ELECTRON EMISSION TECHNIQUE — $ 50,000 — 01-02
D. F. Stein and L. A. Heldt - Dept. of Metallurgical Engineering

Auger electron spectroscopy to study segregation to grain boundaries; embrittlement in Ni, Ni-Al, and Ni-Al-Ti alloys by sulfur; stress corrosion cracking in brass; sensitization of stainless steel; hydrogen embrittlement in Cu.

MINNESOTA, UNIVERSITY OF

253. ANALYSIS OF THE DUCTILE-BRITTLE TRANSITION TEMPERATURE IN FE-BINARY ALLOYS — $ 39,000 — 01-02
W. W. Gerberich - Dept. of Chemical Engineering and Materials Science

Flow and fracture characteristics in binary alloys of Fe; crack growth mechanisms in high strength steel and Ni-base alloys; effect of cohesive energy, strain-rate sensitivity, solid-solution strengthening, solute softening and plastic constraint on the ductile-brittle transition; change-of-strain rate, stress-relaxation, acoustic emission measurements; microscopic crack growth measurements via scanning microscopy and acoustic techniques; initiation and propagation stages of cathodic or gaseous H induced slow crack growth in steels.

254. EXPERIMENTAL INVESTIGATIONS IN SOLID STATE AND LOW TEMPERATURE PHYSICS — $168,460 — 02-02
A. M. Goldman, W. V. Weyhmann, W. Zimmermann, Jr. - Dept. of Physics

Fluctuations occurring in the vicinity of the superconducting-to-normal transition; tricritical point in superconducting films; granular superconductive materials in a photoconductive matrix; low temperature macroscopic and local magnetizations of dilute magnetic ions in Cu, Ag, Au; very low temperature magnetization and heat capacity techniques to study nuclear cooling and nuclear ordering of rare-earth singlet-ground-state systems such as $PrCu_6$ and $PrIn_3$ at temperatures of a few millikelvins; critical behavior of $^3He/^4He$ mixtures near the lambda line and tricritical point; superfluid hydrodynamics.

255. "IN-SITU" ELECTRON MICROSCOPE INVESTIGATION OF THE NUCLEATION AND GROWTH OF SPUTTERED THIN FILMS — $ 41,030 — 01-01
T. E. Hutchinson - Dept. of Chemical Engineering and Materials Science

Nucleation and growth kinetics of vacuum deposited thin films; ultrahigh vacuum "in-situ" electron microscopy; Au on Si, CdS on Si; effects of substrate, temperature, deposition rate, pressure, and residual gases.

NATIONAL ACADEMY OF SCIENCES
NATIONAL RESEARCH COUNCIL

256. CONTINGENCY PLANS FOR CHROMIUM UTILIZATION — $ 50,000 — 01-01
C. W. Spencer - National Materials Advisory Board

Study to be done in cooperation with other Federal agencies and for Cr utilization throughout the economy.

NEW YORK, STATE UNIVERSITY OF

257. SLIP INITIATION AND MICRO-DYNAMICS OF PLASTIC FLOW — $ 50,000 — 01-02
J. C. Bilello - Dept. of Materials Science

Cleavage surface energy measurements on W and Mo; theoretical work to consider cleavage of ionically bonded solids; ultrasonic attenuation and microplasticity observations to clafify the role of dislocation structure, impurities, phonons, electrons, and solutes on dislocation source generation and mobility; etch pit techniques.

258. PREPARATION, CHARACTERIZATION AND USE OF METAL HYDRIDES FOR FUEL SYSTEMS — $ 55,000 — 01-01
P. J. Herley and C. M. Preece - Dept. of Materials Science

Synthesis, decomposition kinetics and the interaction with container materials of the hydrides of various aluminum alloys; synthesize high purity Li, Na, and Mg alanates; hot filament atomic hydrogen charging technique; role of surface film in inhibiting embrittlement.

NORTH CAROLINA STATE UNIVERSITY

259. SORPTION OF CESIUM BY GRAPHITES AT HIGH TEMPERATURES — $ 44,811 — 03-03
L. Zumwalt - Dept. of Nuclear Engineering

Quantitative thermodynamic aspects of the sorption behavior of volatile fission product metals in nuclear grade graphite; cesium sorption isotherms on strontium-impregnated graphite at a series of concentrations from 0 to 1 monolayer Sr, in the temperature range 750 to 1100°C and at Cs equilibrium vapor pressures ranging from 10^{-9} to 10^{-4} atmospheres.

NORTH CAROLINA, UNIVERSITY OF

260. INVESTIGATION OF DEFECT STRUCTURES BY ELECTRIC POLORIZATION AND RELAXATION METHODS — $ 39,500 — 02-02
J. H. Crawford, Jr. - Dept. of Physics

Use of ionic thermocurrent techniques in studying the structure and reorientation mechanism of nearest neighbor and next nearest neighbor trivalent metal ion-interstitial anion complexes in alkaline earth fluorides; rare earth-interstitial F^- and H^- complexes; kinetics of complex formation; electron paramagnetic resonance and infrared spectroscopy.

NORTHWESTERN UNIVERSITY

261. EFFECT OF POINT DEFECTS ON MECHANICAL PROPERTIES OF METALS — $ 49,000 — 01-04
M. Meshii - Dept. of Materials Science

Effect of point defects on the mechanical behavior of metallic single crystals; interstitial atoms produced by 1-2 MeV electron irradiation; diffusion annealing and quenching; interaction between dislocations and point defects; effect of defects on Nb and Fe strength, yielding, and stress-strain curves.

262. BASIC RESEARCH ON CERAMIC MATERIALS FOR ENERGY STORAGE AND CONVERSION SYSTEMS — $ 65,000 — 01-01
D. H. Whitmore - Dept. of Materials Science and Engineering

Fast ion transport in oxides; single and polycrystalline materials; single crystal growth; a.c. conductivity, tracer diffusion, dielectric loss, laser Raman spectroscopy, and nuclear magnetic resonance.

OHIO STATE UNIVERSITY

263. FUNDAMENTAL STUDIES OF METAL FLUORINATION REACTIONS — $ 48,000 — 01-03
R. A. Rapp - Dept. of Metallurgical Engineering

Provide information and understanding of the reactions between fluorine and metals; diffusivity and solubility of fluorine in nickel; fluorine pressure dependence of electrical conductivity and stoichiometry of fluorine compounds; CaF_2 solid electrolyte for fluorine ion transport; effect of oxygen contamination.

OHIO STATE UNIVERSITY (Continued)

264. CORROSION, STRESS CORROSION CRACKING, AND ELECTROCHEMISTRY OF THE IRON AND NICKEL BASE ALLOYS IN CAUSTIC ENVIRONMENTS — $ 50,000 — 01-01
R. W. Staehle and A. K. Agrawal - Dept. of Metallurgical Engineering

Corrosion study of Fe, Ni, Cr and Mo alloys in caustic environments; both aqueous solutions and anhydrous fused melts between room temperature and 800°C; rate laws and kinetic models; general corrosion and stress corrosion cracking; effectiveness of inorganic inhibitors.

OKLAHOMA STATE UNIVERSITY

265. ELECTRONIC STRUCTURE OF DEFECTS IN OXIDES — $ 21,625 — 02-02
G. P. Summers - Dept. of Physics

Electronic structure of F^+ and F centers in single crystal CaO, SrO, ZnO and Al_2O_3; photoconductivity, optical absorption and emission; mechanism of photoconductivity; defect production by electron and proton irradiation.

PENNSYLVANIA STATE UNIVERSITY

266. CERAMIC RESEARCH — $ 32,642 — 01-02
R. C. Bradt and J. H. Hoke - Dept. of Materials Science

Transformational superplasticity in Bi_2O_3, Bi_2O_3-Sm_2O_3, and Bi_2O_3-WO_3, effect of stoichiometry on elastic properties and fracture in TiO_{2-x} and $Fe_{1-x}O$.

267. STUDIES OF MECHANICAL PROPERTIES AND IRRADIATION DAMAGE NUCLEATION OF HTGR GRAPHITES — $ 39,200 — 01-04
P. A. Thrower - Dept. of Materials Science

Radiation damage nucleation in graphite irradiated at elevated temperatures; electron microscopy of single crystals with and without boron; effects of stress on corrosion of graphite by gaseous H_2O and Co; effects of temperature, stress and partial pressures; kinetics and effects on compressive strength.

PENNSYLVANIA STATE UNIVERSITY (Continued)

268. STRUCTURE OF GLASSES CONTAINING TRANSITION METAL IONS — $ 40,000 — 01-01
W. B. White - Dept. of Geochemistry

Structure and stability of insulator glasses with transition metal oxide additives; silicate, borosilicate, germanate and phosphate glasses; Cr, Mn, Ni, and Fe oxide additions; effect of oxygen pressure, time, temperature; laser Raman spectroscopy, optical absorption, luminescence, x-ray diffraction, electron microscopy.

PENNSYLVANIA, UNIVERSITY OF

269. DISLOCATION MOBILITIES IN ORDERED ALLOYS — $ 43,000 — 01-02
D. P. Pope - Dept. of Metallurgy and Materials Science

Mechanism of yield strength increase with temperature for ordered alloys; dislocation velocity, yield stress and work hardening measurements; single crystal Cu_3Au and $Ni_3(Al,W)$.

PITTSBURGH, UNIVERSITY OF

270. THERMAL, STRUCTURAL AND MAGNETIC STUDIES OF METALS AND INTERMETALLIC COMPOUNDS — $ 98,000 — 02-02
W. E. Wallace and V.U.S. Rao - Dept. of Chemistry

Determination of the magnetic behavior of ternary systems containing lanthanides and d-transition metals; the solubility of hydrogen in selected rare earth intermetallics, and surface analyses by Auger and LEED; rates of adsorption and desorption of H_2, and of its diffusion in the lattice by pulsed field gradient NMR methods.

PURDUE UNIVERSITY

271. TRANSPORT AND THERMODYNAMIC PROPERTIES OF SOLIDS — $ 37,000 — 01-03
R. E. Grace - School of Materials Engineering

Chemical interdiffusion and interface stability in solid multicomponent, multiphase alloys; intrinsic and interdiffusion coefficients; Cu-Ni-Zn and Fe-Ni-Al ternary systems; electron microprobe analysis and scanning electron microscopy.

PURDUE UNIVERSITY (Continued)

272. HIGH TEMPERATURE EFFECTS OF INTERNAL GAS PRESSURES IN CERAMICS — $ 48,000 — 01-03
A. A. Solomon - Dept. of Nuclear Engineering

Effects of internal gases and microstructure on rate-controlling mechanisms of pressure induced densification and swelling of ceramics; single and polycrystalline CoO.

RENSSELAER POLYTECHNIC INSTITUTE

273. THE EFFECT OF WELDING VARIABLES ON THE SOLIDIFICATION SUBSTRUCTURE, MECHANICAL PROPERTIES AND CORROSION BEHAVIOR OF AUSTENITIC STAINLESS STEEL WELD METAL — $ 44,000 — 01-01
W. F. Savage and D. J. Duquette - Materials Division

Studies of weld structures containing retained ferrite in stainless steel; effects of elemental redistribution during solidification; role of solution temperature, chloride concentration, and pH on localized corrosion and stress corrosion cracking; ferrite content and distribution will be varied and heat treatments will be developed to redistribute solid solution constituents.

274. FATIGUE BEHAVIOR OF BCC METALS — $ 31,300 — 01-02
N. S. Stoloff - Dept. of Materials Engineering

Fatigue behavior of V and V-H alloys under high cycle (stress controlled) and low cycle (strain controlled) conditions; nucleation sites and propagation paths of fatigue cracks; room temperature and above.

ROCHESTER, UNIVERSITY OF

275. THE MATERIALS AND MECHANICS OF RATE EFFECTS IN BRITTLE FRACTURE — $ 33,000 — 01-02
S. J. Burns - Dept. of Mechanical and Aerospace Sciences

Critical stress intensity factor for propagating cracks; effect of temperature and microstructural variables; emphasis on the brittle region of steels; wedged-double-cantilever beam; crack length measured electrically.

ROCHESTER, UNIVERSITY OF (Continued)

276. DIFFUSIONAL CREEP OF MULTI-COMPONENT SYSTEMS — $ 33,000 — 01-02
J. C. M. Li - Dept. of Mechanical and Aerospace Sciences

Penetration creep of both molecular solid solutions and metallic alloys; theoretical treatments of creep involving a transition of creep behavior in temperature and in stress; composition variations of the activation enthalpy and the stress exponent.

SOUTHERN CALIFORNIA, UNIVERSITY OF

277. ELECTRICAL AND MECHANICAL PROPERTIES OF OXIDE CERAMICS — $ 50,000 — 01-03
F. A. Kroger - Materials Science Dept.

Electrical conductivity and high temperature creep in doped polycrystalline oxides; conductivity, transference numbers, creep; Al_2O_3; effects of oxygen pressure, temperature, grain size; dopant concentration, type, and segregation.

278. GRAIN BOUNDARY SLIDING DURING HIGH-TEMPERATURE CREEP — $ 52,000 — 01-02
T. G. Langdon - Dept. of Materials Science and Mechanical Engineering

Grain boundary sliding during creep at low stress levels; effects of stress, temperature, grain size and crystal structure; relation between grain boundary sliding and cavitation failure; deformation maps; h.c.p. and f.c.c. alloys and ceramics.

STANFORD UNIVERSITY

279. STRUCTURE DEPENDENCE OF HIGH TEMPERATURE DEFORMATION OF METALS — $ 54,999 — 01-02
C. R. Barrett and W. D. Nix - Dept. of Materials Science and Engineering

Control of high temperature mechanical properties through microstructure control; effects of precipitate-free zones on creep and ductility; cavity growth during creep; theory of creep rupture; experimental effects of gas bubbles; H_2O in Ag; effects of sub-micron grain size; theory of irradiation enhanced creep.

STANFORD UNIVERSITY (Continued)

280. DIFFUSION OF OXYGEN IN LIQUID METAL SYSTEMS — $ 28,000 — 01-03
D. A. Stevenson - Dept. of Materials Science

Diffusion of oxygen in liquid metals and alloys using electrochemical techniques and solid electrolytes; Ga-In-O alloys.

TENNESSEE, UNIVERSITY OF

281. MICROSTRUCTURE-PROPERTY RELATIONSHIPS IN AUSTENITIC STAINLESS STEELS — $ 28,000 — 01-01
J. E. Spruiell - Dept. of Chemical & Metallurgical Engineering

Relation of composition, pretreatment and aging to phase stability, recrystallization behavior and tensile behavior; nucleation of carbides and intermetallic compounds during aging; precipitation in types 321 and 304; microstructural stability in 16Cr-8Ni-2Mo; role of carbon on sigma phase precipitation; effect of ferrite content of welds on sigma formation; effect of sigma phase on creep.

282. APPLICATION OF ADIABATIC CALORIMETRY TO METAL SYSTEMS — $ 29,000 — 01-03
E. E. Stansbury and C. R. Brooks - Dept. of Chemical and Metallurgical Engineering

Heat capacity measurements of metals; Sn, Bi, Pb, Ga and stainless steel; 300 to 1300°K; effects of plastic deformation and relation to recovery and recrystallization.

UTAH, UNIVERSITY OF

283. POSITRON LIFETIME MEASUREMENTS AS A NON-DESTRUCTIVE TECHNIQUE TO MONITOR FATIGUE DAMAGE — $ 50,000 — 01-02
J. G. Byrne - Div. of Materials Science and Engineering

Positron lifetime and Doppler annihilation line shape broadening information to monitor fatigue damage in solids; positron lifetime in hydrogen embrittled steels; positron and x-ray studies of fatigue in Ni and Ni-Cu alloys; effects of irradiation on positron lifetime.

UTAH, UNIVERSITY OF (Continued)

284. IMPURITY EFFECTS ON THE CREEP OF POLYCRYSTALLINE MAGNESIUM AND ALUMINUM OXIDES AT ELEVATED TEMPERATURES — $ 33,000 — 01-02
R. S. Gordon - Dept. of Materials Science and Engineering

Relative roles of diffusion and dislocation mechanisms in creep of polycrystalline oxides and role of impurities; MgO, Al_2O_3 and mullite; iron and chromium dopants; effects of impurity type and concentration, temperature, oxygen pressure, and microstructure.

VERMONT, UNIVERSITY OF

285. THERMODYNAMIC AND TRANSPORT PROPERTIES OF INTERSTITIAL HYDROGEN ISOTOPES IN METALS SYSTEMS — $ 23,626 — 02-03
J. S. Brown - Dept. of Physics

Theoretical study of electronic and transport properties of FCC transition metals, Pt, Ni and Pd; muffin Sn potentials used; superconductivity in PdH_n and PdD_n systems; CPA analysis of electron propagation in disordered ternary interstitial alloys.

VIRGINIA, UNIVERSITY OF

286. ELECTRONIC PROPERTIES OF METALS AND ALLOYS AND MOLECULES — $ 87,000 — 02-02
R. V. Coleman - Dept. of Physics

Measurement and analysis of the electronic properties of solids and molecules; band structure of ferromagnetic Fe and Co; superconductivity in the layer structure dichalcogenides NbS_2, TaS_2, $TaSe_2$ and $NbTe_2$; inelastic electron tunneling using doped tunnel junctions.

WASHINGTON, UNIVERSITY OF

287. MÖSSBAUER STUDIES AT HIGH PRESSURE — $ 63,000 — 02-02
R. L. Ingalls - Dept. of Physics

Mössbauer effect in solids under pressure up to 300 kbar; internal magnetic field, isomer shift, and phase changes occurring in transition metals, alloys and compounds containing ^{57}Fe.

WASHINGTON, UNIVERSITY OF (Continued)

288. A STUDY OF PHASE TRANSITIONS AND SUPERCONDUCTIVITY
D. H. Polonis - Dept. of Mining, Metallurgical and Ceramic Engineering — $ 36,143 — 01-03

Relationship between phase transformations, microstructure and superconductivity in metal alloys; precipitation or transformation processes and powder metallurgical fabrication; B-stabilized Zr-Nb alloys, Hf-Nb alloys, A-15 compounds dispersed in metal matrices; effects of microstructure on T_c, H_{c1}, H_{c2} and hysteresis.

WISCONSIN, UNIVERSITY OF

289. VOID NUCLEATION AND GROWTH IN HEAVY ION AND ELECTRON BOMBARDED PURE METALS
G. L. Kulcinski - Dept. of Nuclear Engineering — $ 50,000 — 01-04

Irradiation variables and materials parameters, influencing void nucleation in metals; pure Al and V; effects of He injection and impurities; high voltage transmission electron microscopy.

SECTION C

Summary of Funding Levels

The summary funding levels for various research categories were determined from the index listing in Section D and estimating the percentage from the project devoted to a particular subject. There is overlap in the figures. For instance, funding for a project on diffusion in oxides at high pressure would appear in all three categories of diffusion, oxides, and high pressure.

During the fiscal year ending June 30, 1975, the Materials Sciences Program's total support level amounted to about $39.8 million in operating funds and $3.2 million in equipment funds. These separately identified equipment funds are expended primarily at ERDA Laboratories and are not shown in this report. Equipment funds for the University projects are included in the total contract dollars, being part of the operating budget. The following analysis of costs is concerned only with the $39.8 million operating funds.

1. By Region of the Country:

	Contract Research (%)	Total Program (%)
(a) Northeast ..... (Mass., R.I., Penn., N.Y., N.H., D.C., Md., Vt., Conn.)	44.6	17.1
(b) South ..... (Fla., N.C., Tenn., Va.)	5.6	24.3
(c) Midwest ..... (Ohio, Ill., Wisc., Mich., Minn., Ind., Iowa, Kan.)	23.0	42.9
(d) West ..... (Ariz., Utah, Calif., Colo., Mont., Okla., Ore., Texas, Wash., Hawaii, N.Mex.)	26.8	15.7
	100.0	100.0

2. By Academic Department or Laboratory Division:

	Contract Research (%)	Total Program (%)
(a) Metallurgy, Materials Science, Ceramics (Office Budget Activity Numbers 01-)	60.3	43.5
(b) Physics, Solid State Science, Solid State Physics (Office Budget Activity Numbers 02-)	34.0	40.3
(c) Chemistry, Chemical Eng. (Office Budget Activity Numbers 03-)	5.7	16.2
	100.0	100.0

3. By ERDA Laboratory and University:

	Total Program (%)
(a) University Program (including those laboratories where graduate students are involved in research to a large extent)	36.6
(b) Laboratory Program	63.4
	100.0

4. By Laboratory:

	Total Program (%)
Ames Laboratory	10.8
Argonne National Laboratory	24.7
Brookhaven National Laboratory	12.0
Holifield National Laboratory	23.3
Illinois, University of (Materials Research Laboratory)	3.6
Lawrence Berkeley Laboratory	8.9
Los Alamos Scientific Laboratory	1.2
Mound Laboratory	0.3
Pacific Northwest Laboratory	1.9
Contract Research	13.3
	100.0

5. By Selected Areas of Research:

	Number of Projects (Total=237) (%)	Total Program $ (%)
(a) Materials		
Actinide Metals and Compounds	10.5	7.8
BCC Refractory Metals	17.7	9.8
Ceramics	24.9	15.4
Rare Earth Metals and Compounds	9.7	6.1
(b) Technique		
Neutron Scattering	8.0	15.1
Theory	10.6	7.3
(c) Phenomena		
Diffusion	13.9	6.7
Strength	19.4	10.3
Superconductivity	14.7	9.1
Surface Phenomena and Thin Films	13.1	7.8
Void Formation	6.3	6.3
(d) Environment		
High Pressure	4.2	3.4
Hydrogen	13.5	5.0
Radiation	17.3	19.7

SECTION D

Index of Investigators,
Materials, Phenomena,
Technique and Environment

The index refers to project numbers in Sections A & B.

Actinide Metals and Compounds

1	72
3	73
5	74
24	85
25	99
26	102
39	132
40	138
44	140
45	144
50	145
67	146
71	

Ceramics

Carbides	Glass	Nitrides	Oxides			
44	9	44	2	44	80	238
45	38	45	3	45	82	240
67	127	50	24	58	84	241
99	268	67	25	60	85	242
116		74	27	64	125	243
118		75	28	66	127	248
119		79	32	67	145	262
141		99	33	71	201	265
222		207	34	72	213	266
230		215	35	74	215	272
250		250	36	75	224	277
						284

Complex Materials Systems

3	98
19	118
21	120
46	123
47	134
49	138
52	139
53	256
94	273
95	281

Composites

1	73
3	105
54	124
55	126
68	211
72	226

Graphite, Carbon, and Coal

23
60
80
96
126
138
259
267

Hydrides

5	39
7	43
15	79
25	101
29	106
33	258

Intermetallic Compounds

3	76
7	78
14	79
24	89
25	106
26	136
29	147
39	207
40	254
54	270
55	288
61	

Ionic Crystals

Alkali Halides

34			
35			
64			
82			
110			
230			

Other

5	33	50	113
9	35	57	133
10	42	59	229
17	43	64	255
20	48	65	260
22	49	95	263
			286

Liquids

1	47
5	48
10	60
12	93
15	95
19	144
33	218
38	220
46	280

Metals

Alkali

15
47
52
143
144
218
220
230
259

BCC Refractory

1	107
2	108
3	109
24	124
28	143
30	148
31	204
37	212
40	216
42	221
47	222
70	231
73	235
74	237
75	244
77	256
81	257
82	261
89	274
91	288
103	289

Ferrous

1	218
27	225
32	227
77	228
82	252
118	253
119	261
120	264
202	273
203	275
213	281
214	282
	283

MHD Materials

2
24
34
66
68

Organics

5
9
10
18
51
53
92
102
109
115
116
133
236
238
276

Rare Earth Metals and Compounds

2
3
5
9
10
11
14
29
33
34
36
39
57
78
79
80
118
207
209
250
254
260
270

Semiconductor

9
10
34
46
79
82
86
121
130
135
215

Acoustic Emission

104
253

Auger Spectroscopy

1
54
61
83
140
252
270

Computer Simulation

27
28
38
63
87
135
206
234
245

Elastic Constants

3
28
111
230
237

Electron Microscopy

3	101	205	248
4	106	213	253
28	107	216	255
30	119	223	267
31	121	224	268
32	125	225	271
77	148	234	289
91	202	235	

Electron Spin Resonance

16
23
35
38
85
115
260

Field Ion Microscopy

23
231

High Temperature Heat Capacity

19
44
50
220
282

Infrared Spectroscopy

49
96
130
133
229
239
260

Internal Friction

103
111
142
144
212
235

Laser Beam Scattering

48
84
129
215
219
246
247
262
268

Low Temperature Specific Heat

3
8
9
16
26
29
36
39
45
76
100
210

Magnetic Susceptibility

3
6
24
26
39
100
202
207
210
254
270

Mass Spectrometry

123
141
241
250

Mossbauer Effect

7
26
29
39
287

Neutron Scattering

5	78
15	79
25	80
33	81
43	92
57	93
58	201
59	246
60	249
66	

Nuclear Magnetic Resonance

7	102
16	109
23	115
24	137
29	262
38	270

Optical Spectroscopy

10
64
84
110
114
238
265
268

Positron Annihilation

28
64
65
283

Sputtering

30
31
37
46
108
135
147

Theory

12
13
14
24
27
28
31
41
63
69
87
120
122
123
131
135
136
138
148
203
208
211
226
232
285

Thermal Conductivity

8
51
75
220
240
251

Thermodynamics

9
20
44
47
48
50
95
99
123
136
241
250
285

X-Ray Scattering

3	92
15	93
24	114
25	116
27	117
43	144
44	145
54	201
65	204
71	268
91	

Catalysis

18
23
38
83
96

Channeling

31
46
65
83
87
90

Corrosion

1
52
97
218
252
263
264
273

Crystal Structure, Atomic Distribution and Crystal Transformations

3	70	147
15	79	201
22	92	202
24	93	204
25	101	226
38	119	245
43	120	266
44	122	268
54	136	270
58	146	288
67		

Diffusion

1	94	223
3	103	225
21	109	231
28	112	246
32	127	248
38	134	261
44	137	262
52	141	263
69	143	270
73	144	271
74	222	280

Dislocations

27	235
69	245
91	248
103	251
121	257
212	261
221	269

Erosion

118
120

Electron Transport

4	85
6	112
8	116
9	126
17	128
26	133
40	212
55	233
61	236
63	243
66	262
75	286

Electronic Structure

Fermi Surface	Other	
6	6	100
14	24	110
24	26	115
26	29	131
40	41	141
232	63	247
	69	265
	87	286

Magnetism

3	57
5	63
6	78
14	100
16	115
24	137
25	207
26	210
33	249
37	254
39	286
41	287
43	

Materials Preparation and Characterization

1	55
2	82
11	98
17	99
18	124
34	211
54	

Phonons

5	87
33	114
36	129
41	215
57	229
59	249
79	257

Point Defects

26	112
28	117
30	121
31	206
32	216
35	223
41	231
56	248
63	261
69	265
87	277
103	

Precipitation

1	108
32	121
53	217
55	234
70	279
107	281

Recovery and Recrystallization

27	231
72	261
121	281
204	282
216	

Sintering

118
124
125
127
242
248
272

Solidification

1
68
273

Strength

Fracture		Fatigue	Creep	Flow Stress	
2	203	27	27	1	216
4	225	142	72	2	227
27	235	218	77	27	228
72	252	274	142	55	230
77	253	283	146	72	235
104	257		203	105	244
106	266		242	106	245
120	275		248	108	257
142			276	116	261
			277	120	267
			278	122	269
			279	205	281
			284	212	

Stress-Corrosion Cracking

97
104
214
252
264
273

Superconductivity (35 papers)

3	55	147
7	61	204
8	76	208
13	80	209
15	81	221
24	87	232
29	89	233
30	111	236
33	124	240
36	128	254
37	131	288
54	132	

Surface Phenomena and Thin Films

1	97	228
9	101	238
12	134	248
22	139	252
23	140	255
46	141	258
60	215	259
61	218	264
73	219	270
83	223	278
96		

Void Formation

4	205
30	206
32	213
71	216
77	217
80	231
117	289
148	

Gas

Oxidizing	Hydrogen	
1	1	111
73	2	115
94	3	138
108	7	140
109	25	143
207	28	144
277	33	212
280	41	214
284	43	225
	46	252
	85	253
	94	258
	103	270
	106	274
	107	283
	109	285

Magnetic Field

3	39
6	40
14	43
24	55
25	78
26	115
33	124

Pressure

Above Atmospheric
9
26
33
110
111
112
133
230
237
287

Radiation

Electron	Ion		Neutron		Theory	Gamma
28	28	88	4	89	63	35
31	30	90	30	142	87	64
32	31	145	42	148	88	
42	32	146	56	202	91	
56	42	148	64	216	117	
64	46	202	77	240	206	
77	56	205	81	244	217	
117	64	216	88	267	279	
121	65	231				
213	77	239				
261	87	289				
265						

Temperature

Very Low Temperatures

8	63
26	132
29	210
36	229
37	236
45	240
62	254

High Temperatures

17	95
19	98
20	123
22	136
44	141
46	144
47	220
48	241
51	247
53	250
66	259
85	