

**METALLURGY
AND
MATERIALS
PROGRAMS**



FY 1973

UNITED STATES ATOMIC ENERGY COMMISSION
DIVISION of PHYSICAL RESEARCH

LEGAL NOTICE

This report was prepared as an account of work sponsored by the United States Government. Neither the United States nor the United States Atomic Energy Commission, nor any of their employees, nor any of their contractors, subcontractors, or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness or usefulness of any information, apparatus, product or process disclosed, or represents that its use would not infringe privately owned rights.

WASH-1181-73

METALLURGY
AND
MATERIALS
PROGRAMS
Fiscal Year 1973

July 1973

U. S. Atomic Energy Commission
Division of Physical Research

FORWORD

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

This report contains a listing of all research underway in FY 1973 together with a convenient index to the program.

Donald K. Stevens
Assistant Director (for Metallurgy
and Materials Programs)
Division of Physical Research

INTRODUCTION

The purpose of this report is to provide a convenient compilation and index of the AEC's Metallurgy and Materials Programs. This compilation is intended for use by administrators, managers, and scientists to help coordinate research and 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 DY 1973 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 Physical Metallurgy and Ceramics (01) or Solid State Physics (02). The budget numbers carry the following titles:

- 01-01 - Materials, Properties and Processes
- 01-02 - Structure of Materials
- 01-03 - Radiation Damage

- 02-01 - Materials Preparation and Characterization
- 02-02 - Crystal Physics
- 02-03 - Energetic Particle Interaction

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
Metallurgy and Materials Programs
Division of Physical Research

TABLE OF CONTENTS

SECTION A - Laboratories

	<u>Page</u>
Ames Laboratory	1
Argonne National Laboratory	6
Brookhaven National Laboratory	12
Illinois, University of	16
Lawrence Berkeley Laboratory	20
Oak Ridge National Laboratory	25
Pacific Northwest Laboratory	32

SECTION B - Universities

Alphabetical Listing	35-59
--------------------------------	-------

SECTION C - Funding Levels

Region	63
Department	63
Laboratory versus University	64
Laboratories	64
Research Area	65

SECTION D - Index

Investigators	A1
Materials	A6
Technique	A10
Phenomena	A15
Environment	A20

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 1973.

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

Metallurgy Division -01-
 M. S. Wechsler - Phone: 294-1821

1. MECHANICAL BEHAVIOR \$100,000 01-01
 D. T. Peterson, T. E. Scott

Relation between metallurgical structures and the strength and ductility of metals and alloys; dispersed particle strengthening in Cu-Co; hydrogen embrittlement in V, Nb, and Ta; alloy hardening due to N in Th; deformation of Y and rare earth metals; precipitation hardening in V; dispersed particle strengthening in Th-Zr-C; creep studies of refractory metals with H.

2. METAL PURIFICATION AND IMPURITY \$116,500 01-01
 EFFECT STUDIES
 O. N. Carlson, D. T. Peterson,
 F. A. Schmidt

Development of new or improved methods for the preparation of ultra-high purity metals of interest to nuclear technology; purification by electrotransport of V, Mo, Th, Gd, Hf, and U; preparation of Sc by metallothermic reduction; electroslog refining; effects of impurities and irradiation on plastic deformation and fracture of V.

3. CERAMICS RESEARCH \$133,500 01-01
 M. F. Berard, O. Hunter,
 D. R. Wilder

Studies of refractory oxides and other ceramic materials; thermal and mechanical properties; diffusion; HfO_2 , Y_2O_3 , rare earth oxides; thermal diffusivity and conductivity of Er_2O_3 and Eu_2O_3 ; interdiffusion in CaF_2 - SrF_2 and Er_2O_3 - HfO_2 ; elastic properties of stabilized rare earth oxides.

AMES LABORATORY
Metallurgy Division -01- (Continued)

4. PHYSICOCHEMICAL PROPERTIES \$273,500 01-02
D. M. Bailey, K. A. Gschneidner,
F. X. Kayser, O. D. McMasters,
J. F. Smith, D. E. Williams

Crystallographic, thermodynamic, elastic, magnetic properties; rare earth metals and alloys, alkaline earth metals, thorium alloys; low temperature magnetic susceptibility, electrical resistivity, and specific heat of polymorphic phases in Ce; high temperature heat contents of EuX ($X=0, \text{S}, \text{Se}, \text{Te}$); effect of alloying on phase stability and superconductivity of La_3In ; low temperature specific heat of rare earth-lead compounds; single crystal preparation of Ce, Pr, and Nd; magnetic susceptibility of Pb-Tl-Bi; elastic behavior and superconductivity in La intermediate phases; low temperature elastic constants of single crystal Pr; structure and properties (lattice parameter and density) of carbon steels.

5. DIFFUSION AND TRANSPORT PROPERTIES \$157,000 01-02
O. N. Carlson, D. T. Peterson,
F. A. Schmidt, J. D. Verhoeven

Diffusion, electrotransport, thermotransport and solute redistribution during solidification; diffusion and electrotransport of C, O, and N in Ti, C in Mo, N in Fe, and Cd in liquid Hg; thermotransport in Th; composite-to-dendrite transition and scanning-electron-microscope investigation of solidification in Sn-Pb; effect on solidification of magnetic field in Sn-Cd and Al-Cu and electric field in Sn-Pb and Sn-Bi.

6. PROPERTIES OF SURFACES \$ 19,500 01-02
R. K. Trivedi

Properties, structure, energetics and kinetics of metallic surfaces and interfaces, LEED-Auger analysis of refractory metals, surface energy and atomic mobility in V, epitaxial formation of thin films, surface diffusion in BCC metals, growth of dendritic interfaces.

7. RADIATION DAMAGE \$135,000 01-03
C. W. Chen, M. S. Wechsler

Neutron irradiation studies using Ames Laboratory Research Reactor, including liquid nitrogen irradiation facility and neutron convertor facility; resistivity, internal friction, plastic deformation, fracture, and electron microscopy; void formation, voids in quenched and irradiated Ni; radiation hardening and embrittlement in high purity and oxygen-doped V and in high purity and carbon-doped Th.

AMES LABORATORY

Physics Division -02-

R. G. Barnes - Phone: 294-5442

8. MATERIALS, PREPARATION AND CHARACTERIZATION \$130,000 02-01
F. H. Spedding, G. Burnet

Methods of preparing rare earth metals in highly purified and single crystal form, and the study of the effect of various impurities on the physical properties of these metals; La reduction of Dy_2O_3 preparation of ultra-pure rare earth fluorides; effects of interstitial impurities on the magnetic properties of Sc, Y, La.

9. ELECTRONIC STRUCTURE AND MAGNETIC PROPERTIES OF METALS \$127,000 02-02
S. Legvold, S. H. Liu,
J. L. Stanford, L. Hodges

Electronic properties of metals and their relation to the magnetic properties, band structure and Fermi surface calculations of transition metals and their compounds, itinerant antiferromagnetism in CrB_2 , effects of alloying on the magnetic properties of transition and rare-earth metals, cluster properties of CuNi alloys, ferromagnetic resonance in $SmCo_5$ -type alloys, local spin fluctuations in paramagnetic Cr, and magnetic excitations in disordered spin systems.

10. NUCLEAR RESONANCE IN SOLIDS \$ 87,000 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 phase transition and self-diffusion in transition metal deuterides, microscopic nature of the magnetic transition in magnetic inter-metallic systems, phase transition in superconducting intermetallic compounds.

11. SUPERCONDUCTIVITY \$151,000 02-02
J. R. Clem, D. K. Finnemore,
J. E. Ostenson

Effect of non-magnetic resonant states on superconductivity, magnetic impurity scattering in superconductors, interaction between quantized vortices in Nb and V, theoretical studies of surface pinning and edge pinning in superconductors, theoretical study of energy dissipation during flux motion, superconductivity in laminar compounds, thermal conductivity and electron tunneling studies of the superconducting energy gap, studies of superconductivity in compounds with highly anisotropic chemical binding.

AMES LABORATORY

Physics Division -02- (Continued)

12. LOW TEMPERATURE, HIGH PRESSURE STUDIES \$ 79,500 02-02
C. A. Swenson, M. S. Anderson

Thermodynamic properties and equations of state of solids, thermal expansion and specific heat measurements to 1 K, temperature scale from 1 to 30 K, P-V-T measurements to 20 kbar and 4 K on inert gas solids and alkali metals, thermal expansion of potassium and copper.

13. TRANSPORT PROPERTIES OF SOLIDS \$230,500 02-02
G. C. Danielson, P. H. Sidles,
H. R. Shanks, A. J. Bevolo

Thermal conductivity of vanadium; filament formation and switching properties of As-Ge-Te glasses; heat capacity, magnetic susceptibility, and superconductivity of tungsten bronzes; crystal growth of chalcogenide layer compounds; sputtering of thin-film amorphous samples.

14. OPTICAL PROPERTIES OF SOLIDS \$158,500 02-02
D. W. Lynch, C. G. Olson,
R. Fuchs, K. L. Kliewer

Experimental and theoretical research on optical properties of metals, alloys, and insulators. Reflectivity measurements on Nb, Ta, V, Mo, rare earth trifluorides, and NbN using synchrotron radiation; infrared absorption in Nb, Mo, V, Ta, and Y; thermomodulation studies on Nb, Ta, and V; Stark effect of excitons in TlCl and TlBr. Theory of optical properties of thin films of metals and ionic crystals; non-local optical properties of solids; boundary conditions in calculations of optical properties; effects of band structure of plasmon dispersion and lifetime in metals; x-ray Compton and Raman scattering in metals.

15. LATTICE DYNAMICS AND NEUTRON SCATTERING IN SOLIDS \$339,000 02-02
S. K. Sinha, C. Stassis,
J. G. Traylor, N. J. Chesser,
G. R. Kline

Neutron scattering and phonon dispersion relations for the high pressure quantum solids, fcc and hcp ^4He , for two forms of Ce metal, $\beta\text{-Ce}$ and $\gamma\text{-Ce}$, for Cr-Mn alloys, and for the semiconducting compound, GaSb; polarized neutron study of the antiferromagnetic transition in Cr metal; excitations in the quantum solid para-deuterium and in solid nitrogen.

AMES LABORATORY

Physics Division -02- (Continued)

<u>16.</u>	OPTICAL AND MAGNETIC PROPERTIES OF RARE EARTH SALTS, SOLUTIONS, METALS AND ALLOYS	\$237,500	02-02
------------	---	-----------	-------

F. H. Spedding, W. J. Haas

Laser Raman spectroscopy of solutions containing La, Gd, and Lu chlorides, magnetic susceptibility of single and polycrystalline Lu and Y and of polycrystalline La; low temperature absorption spectra and Zeeman effect of rare earth ions in rare earth ethylsulfates and garnets; phase transitions in rare earth compounds and with the zircon structure.

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

17. ACTINIDE MATERIALS \$279,000 01-01
 A. J. Arko, A. R. Harvey,
 M. B. Brodsky

Electronic structure of actinide metals, alloys and compounds, low temperature specific heat measurements on actinide compounds, local magnetic moment formation in pseudo-binary system $\text{NpRu}_2\text{-NpOs}_2$, f-band development in actinide- Rh_3 compounds, self-irradiation damage in Pu-U-Al system, scattering temperature anisotropy in Mo alloys, Fermi surface of Tc and LaB_6 , resistivity and susceptibility of rare earths and actinides at high pressures crystal growing.

18. METAL PHYSICS \$386,000 01-01
 N. L. Peterson, Wei-Kong Chen,
 E. S. Fisher, N. Lam, J. N. Mundy,
 S. J. Rothman, C. Tse, D. G. Westlake

Defect structure and cation self-diffusion in Fe_{1-x}O , transport properties in CoO-NiO couples, pressure dependence of magnetic susceptibility in U, elastic moduli of V base solid solutions and of actinide metals and compounds, pressure dependence of the elastic moduli in Re, Ru, and CoO, effect of irradiation on self-diffusion in Ag, calculations of point-defect distribution in metals under irradiation, low temperature diffusion of Co in V, isotope effect on the V-H solvus, diffusion of H isotopes in Nb, effect of resonant vibrational modes on diffusion, self-diffusion in Cr and the isotope effect, diffusion of V in Cr.

19. MECHANICAL PROPERTIES \$286,000 01-01
 U. F. Kocks, R. O. Scattergood,
 E. S. P. Das, P. D. Neumann,
 H. C. Freyhardt

Theoretical and experimental research on fundamental aspects of the mechanical properties of materials, the flow stress of metals and alloys, dynamic computer modeling of dislocation motion through individual obstacles and random arrays, work hardening and dynamic recovery, crack propagation in Cu single crystals under cyclic loading, creep, grain boundary deformation, structure characterization of deformed Cu crystals by x-ray diffraction, flux pinning by voids in superconducting Nb.

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

20. KINETIC STUDIES \$187,000 01-01
 H. Wiedersich, J. W. Miller,
 F. V. Nolfi, Jr.

Investigations into forces and mechanisms that lead to the formation of defect aggregates, precipitates and other inhomogeneous distributions of atoms in solids, precipitation of He in Cu, location of Au atoms in Sn from channeling experiments, clustering of Au interstitials in Sn, thermodynamics of stressed solids. Dynamic interaction between radiation and second phases, including gas bubbles; nucleation theory for solids under irradiation.

21. ALLOY PROPERTIES \$600,000 01-02
 F. Y. Fradin, A. T. Aldred,
 G. S. Knapp, D. J. Lam,
 F. M. Mueller, B. W. Veal, Jr.

Electronic structure of metals with emphasis on actinides and superconducting alloys, alloy chemistry of binary compounds of Np, magnetic properties of actinide compounds, NMR on actinide compounds, optical reflectivity of thorium, crystal-field theory of actinides, NMR and Mossbauer effect on transition metal superconductors, specific-heat studies of superconductors between 1.5 and 430°K, reflectivity studies of Mo and Ni, theoretical calculations of electronic structure of Mo with dilute impurities, theory of positron annihilation and Compton scattering, magnetism in Fe-Cr and Fe-V alloys, X-ray induced electron emission spectroscopy.

22. SCATTERING STUDIES \$453,000 01-02
 M. H. Mueller, G. H. Lander

Magnetic scattering of neutrons from materials with localized moments in the binary compounds NpN, NpP, NpAs, NpS, NpPd₃, PuN, low temperature x-ray studies to identify distortions from magnetic ordering, polarized neutron study of TmSb and Tb(OH)₃ for form factor determination, inelastic neutron scattering for crystal-field levels, V deuteride crystal structure, magnetic and structural transitions in F₃O₄, defect CeO_{2-x} and crystal structure near the melting point of CuCl.

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

23. RADIATION EFFECTS \$421,000 01-03
 T. H. Blewitt, A. C. Klank,
 B. A. Loomis

Point defect production, annihilation and clustering, factors influencing void formation, radiation effects in superconductors, radiation sources include the CP-5 low temperature facility, 4 MeV Dynamitron and plan to use LASL meson facility, radiation effects in Nb, neutron sputtering, impurity-interstitial binding energy, magnetization of Tc as a function of neutron bombardment, flux pinning, replacement collision studies, low temperature irradiation damage and recovery in BCC and HCP metals.

24. CHARGED PARTICLE IRRADIATION \$228,000 01-03
 K. L. Merkle, P. P. Pronko,
 W. Kesternich

TEM studies of displacement cascades in Au, self-ion bombardment with 300 keV heavy ion accelerator, influence of channeling on defect production, ion backscattering studies of dechanneling at defect clusters, thin film electrical resistivity studies, replacement sequences, diffusion and clustering of self-interstitial and inert gas atoms in metals.

Solid State Science Division -02-
 O. C. Simpson - Phone: 739-3141

25. MATERIALS PREPARATION \$108,000 02-01
 AND CHARACTERIZATION
 S. Susman, D. Hinks

Preparation of metal, insulator and semiconductor single crystals with documented physical and chemical characteristics: KCN, NaCN, KCl, LiCl, rare earth oxides Yb₂O₃, Dy₂O₃ and Er₂O₃, rare earth hexaborides, zinc-gadolinium; purification by halogen and hydrohalogen gases.

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

26. NEUTRON SCATTERING STUDIES \$673,000 02-02
 T. Brun, G. Felcher,
 D. L. Price, J. M. Rowe,
 T. Worlton

Slow neutron inelastic scattering, neutron diffraction of magnetic systems, high pressure neutron diffraction; 3-beam facilities at CP-5, thermal neutron time-of-flight inelastic scattering facility, crystal diffractometer equipped with a polarizer and high field-low temperature sample environment, high pressure time-of-flight diffractometer; diffusion of hydrogen and structure of metal hydrides VH_x , VD_x , TaH_x , PdH_x , PdD_x ; liquid dynamics liquid Rb, liquid RbBr, He^3 - He^4 solutions; dynamics of amorphous materials, glassy carbon, vitreous BeF_2 ; molecular crystals KCN, NaCN, alkali hydrosulfides; lattice dynamics solid Rb, RbK_x , CdTe; crystal fields in magnetic systems PrAg; magnetic scattering TmSb, $Tb(OH)_3$; high pressure diffraction to 40 Kb on KCN phases, cobaltous oxide, ferrous sulfide and impurities.

27. DEFECTS AND IMPURITIES \$281,000 02-02
 IN NONMETALLIC SYSTEMS
 P. Yuster, C. Delbecq,
 S. Marshall, J. McMillan,
 D. Schoemaker, S. Susman

Processes which occur during and after exposure of nonmetallic crystals to ionizing radiation, nature of defects, interaction of defects with the lattice modes of the host crystal and with other defect species, structure and jump reorientation kinetics of $BrCl^-$ and Cl_2^- associated with positive ion vacancies, alpha-band absorption in KBr, KI and KCl, polarization characteristics and effect of magnetic field on recombination afterglow for $Ag^0 + Cl_2^-$; ESR studies on impurities and defects, monovalent iron in ThO_2 , trivalent gadolinium in ThO_2 , trivalent iron in $CaCO_3$, XO_3 type molecule ions in $CaCO_3$, trivalent chromium in MgO, divalent manganese in MgO; temperature and magnetic field dependence of spin relaxation times.

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

28. LOW TEMPERATURE STUDIES \$226,000 02-02
 H. Culbert, J. Ketterson,
 M. Kuchnir, P. Roach

Studies of the properties of quantum liquids and solids at very low temperatures, ion and electron motion in ^3He - ^4He solutions and sound dispersion in liquid ^4He ; development of new materials for adiabatic cooling; magnetic susceptibility and specific heat measurements on La-20% Ce at 40 mK - 15 K, high resolution specific heat measurements on magnetic transition in Er_2O_3 , specific heat of glassy carbon.

29. SUPERCONDUCTIVITY STUDIES \$198,000 02-02
 R. Huebener, K. Gray

Magnetic structures and transport properties of superconductors using high resolution magneto-optical techniques, relaxation time for magnetic flux penetration, dynamic behavior of flux structures, electrical and magnetic properties at very high transport currents, effects of light on superconductivity, flux flow studies using tunneling techniques, stoichiometry of anodized niobium surfaces.

30. PHASE TRANSITIONS \$267,000 02-02
 AND CRITICAL PHENOMENA
 L. Guttman, H. Kierstead,
 D. E. O'Reilly

Study of transitions in order-disorder systems, ferroelectric materials and antiferroelectric materials, glassy systems, liquid helium, using techniques of x-ray scattering, ESR, NMR; gas-liquid critical region in He^4 , thermodynamic properties of ^3He - ^4He mixtures, critical ordering in Fe_3Al , spin-lattice relaxation times and self-diffusion and molecular rotation in liquids, ENDOR studies of paramagnetic surface state species, alkali metal cyanides.

31. ELECTRONIC AND \$273,000 02-02
 MAGNETIC PROPERTIES
 B. Dunlap, J. Ketterson,
 L. Windmiller

Mössbauer studies of magnetic properties and electronic structure of actinides, Fermi surface studies; ^{243}Am in actinide compounds, Yb intermetallics, isomer shifts in Pt-Ir alloys, Np Laves phases; dHvA effect in Au, Pd, Pt, Rh, Ir, Nb; band calculations in Pd, Pt, Nb; pressure dependence of the Fermi surface in Au.

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

32. SOLID STATE THEORY \$331,000 02-02
T. Arai, T. Gilbert,
F. Mueller, A. Rahman,
J. Robinson, D. Smith

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 dynamic calculations, statistical mechanics of computation, 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.

33. ENERGETIC PARTICLE INTERACTION \$203,000 02-03
J. Jackson, W. Primak,
P. Vashishta

Radiation effects caused by ion, electron and neutron bombardments; elementary defects and their interactions in metals, defect production and trapping rates, distribution of defects, properties of divacancies and larger cluster, impurity effects, deviations from Matthiessen's rule, theoretical studies of defect formation and migration in metals; radiation damage in insulating materials, optical and electrical effects, dimensional changes, stress formation and relief, surface destruction, lithium niobate, sapphire, spinel, lucalox, barium titanate, quartz.

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

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

34. SUPERCONDUCTIVITY \$315,000 01-02
 M. Strongin, O. Kammerer, T. Luhman
 A. Sweedler, J. Crow, M. Suenaga,
 J. Anne, D. G. Schweitzer

Properties of superconductors - study of the properties of cryogenically deposited thin and ultra thin films, their critical temperature, divergent fluctuations, surface and nucleation studies, search for excitonic mechanism for inducing superconductivity in thin Pb layers on PbTe - impurity and microstructural effects on Nb cavities - preparation of unstable superconductors by quenching and high pressure-coherent behavior in weakly linked superconductors - LEED, Auger.

35. RELATIONSHIP BETWEEN \$ 80,000 01-02
 PROPERTIES AND STRUCTURE
 M. Suenaga, J. Anne,
 T. Luhman

Basic studies of the relationship of defects to macroscopic properties - interactions of quantized magnetic vortices with lattice defects in relationship to the critical current densities of hard superconductors - development, fabrication and evaluation of high critical current, high magnetic field, and high temperature A-15 superconductors - kinetics and mechanisms of the A-15 superconducting compound growth at the Nb-(Cu-Sn) alloy interface and V-(Cu-Ga) alloy interface and 60 Hz ac losses in A-15 compounds - the study of the effect of impurities, microstructure and heat treatment on the breakdown of rf cavities.

36. RADIATION DAMAGE \$ 65,000 01-03
 D. G. Schweitzer, D. M. Parkin
 J. Chow

Electron, neutron and high energy (30 GeV) proton irradiation of NbTi, Nb₃Sn, V₃Ga multifilamentary superconductors at ambient, liquid nitrogen and liquid He temperatures - neutron electron and gamma radiation effects on hollow type I cylinders and type A-15 wire superconductors - recovery of J_c and T_c on annealing post irradiation.

BROOKHAVEN NATIONAL LABORATORY

Department of Physics -02-

B. C. Frazer - Phone: 345-3876

NEUTRON SCATTERING STUDIES \$1,376,000 02-02

37. LATTICE DYNAMICS AND PHASE TRANSFORMATIONS \$475,000

G. Shirane, J. D. Axe,
S. Shapiro, J. Skalyo,
J. Kjems, W. B. Yelon

Effect of superconducting energy gap on phonon linewidths in Nb₃Sn, critical neutron scattering in SrTiO₃ and KMnF₃ transitions, neutron scattering studies of ND₄Cl in the tricritical region, Raman scattering from polar phonons, resolution effects in triple-axis neutron spectrometry.

38. DYNAMICS OF CONDENSED PHASES OF RARE GASES \$292,000

G. Shirane, L. Passell,
J. Skalyo, Y. Endoh

Phonon dispersion in bcc and hcp He-4 crystals, single-particle excitations for high energy and momentum transfers in both He-4 solid phases, high precision neutron measurements of phonon dispersion and line shapes in solid neon and krypton.

39. MAGNETIC SCATTERING \$234,000

G. Shirane, L. Passell,
D. E. Cox, Y. Endoh,
W. B. Yelon

Spin waves and two-dimensional magnetic ordering in K₂MnF₄ absolute measurements of inelastic magnetic scattering of neutrons by MnF₂, magnetic scattering study of paramagnetic γ phase of solid O₂.

40. MAGNETIC STRUCTURES \$196,000

D. E. Cox, B. C. Frazer

One-dimensional magnetic order in RbMnBr₃ and CsMnBr₃, two-dimensional magnetic order in BaCoF₄, magnetic structures of Ba₂MReO₆ compounds.

BROOKHAVEN NATIONAL LABORATORY
Department of Physics -02- (Continued)

NEUTRON SCATTERING STUDIES (Cont'd) \$1,376,000 02-02

41. COLD NEUTRONS \$179,000
 G. Shirane, A. Kevey,
 F. Langdon, L. Passell,
 B. C. Frazer

Safety and component performance tests for Cold Moderator Project, design of basic experimental equipment for the three cold neutron beams.

42. THEORY \$151,000
 M. Blume, R. E. Watson,
 R. A. Bari, A. D. Novaco

Electronic and magnetic properties of solids, lattice vibrations, static and dynamic properties of one-dimensional magnetic systems, first-order phase transitions, properties of monolayer helium films, superconductivity and ferroelectricity, electronic properties of rare-earth metals.

43. SUPERCONDUCTIVITY \$123,000
 M. Strongin, J. E. Crow,
 M. N. Varma

Superconducting properties of ultra-thin films of Al and of thin layers of Pb on PbTe substrates, study of low concentration oxygen impurities at and near surface in niobium, penetration depth of transition metal superconductors (Nb and Ta), coherent behavior in weakly linked particle of superconducting Al, investigation of superconductors doped with magnetic impurities: $\text{La}_{1-x}\text{Ce}_x\text{Al}_2$, $\text{La}_{1-x}\text{Gd}_x\text{Sn}_3$ and $\text{La}_{1-x}\text{Tm}_x\text{Sn}_3$.

ENERGETIC PARTICLE INTERACTIONS \$771,000 02-03

44. METALS AND ALLOYS \$283,000
 A. N. Goland, D. T. Keating
 F. Geisler, I. Golovchenko

Defect studies employing positron-annihilation lifetime measurements in Al, Au, and in Al with low concentration impurities of Zn and of He, x-ray and neutron scattering studies of the omega phase transformation in $\text{Zr}_{1-x}\text{Nb}_x$ alloys, neutron diffraction study of amorphous $\text{Ge}_{.17}\text{Te}_{.83}$, internal friction measurements in electron-irradiated Au.

BROOKHAVEN NATIONAL LABORATORY
Department of Physics -02- (Continued)

ENERGETIC PARTICLE INTERACTIONS (Cont'd) \$771,000 02-03

45. NON-METALS \$331,000

P. W. Levy, A. N. Goland,
 D. T. Keating, F. Geisler,
 I. Golovchenko

Simultaneous optical absorption and luminescence measurements during electron irradiation of LiF and during Co-60 gamma irradiation of natural and synthetic quartz, radiation effects in pseudostable ammonium perchlorate, study of charged-particle tracks in dielectric materials, proton channeling studies of very thin Si crystals.

46. THEORY \$157,000

G. J. Dienes, D. O. Welch,
 A. N. Goland, D. T. Keating

Kinetics of defect formation in alkali halides irradiated at He temperatures, models for Mn⁰ centers in NaCl, co-valent bond charge densities and harmonic and anharmonic force constants in diamond-type structures, theory of x-ray scattering from elastically anisotropic hcp crystals containing interstitial dislocation loops.

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

Department of Metallurgy
and Mining Engineering -01-
 C. A. Wert - Phone: 333-1440

47. INTERSTITIAL SOLID SOLUTIONS \$ 42,000 01-02
 C. J. Altstetter

Interstitial solute atoms in metals, their solubilities, precipitation and effect on mechanical properties are being investigated. The heat and entropy of O in Nb and Ta through the measurement of the emf of solid electrolyte cells has been accomplished. Electron microscope observation of precipitates and tensile tests of Nb-O, V-N and Nb-N-O alloys.

48. ELECTRONIC STRUCTURE AND \$ 46,000 01-02
 MAGNETISM OF TRANSITION
 METAL ALLOYS
 P. A. Beck

The magnetic properties of alloys of the 3d transition metals are under study. Re-Co, Cr-Fe, Cr-Fe-Al and Au-Mn alloys are investigated through measurements of magnetic susceptibility, specific heat and electrical resistivity over a wide range of temperature.

49. POINT DEFECT - DISLOCATION \$121,000 01-02
 INTERACTIONS
 H. K. Birnbaum

The diffusion of hydrogen and its isotopes in Fe and Nb is being investigated from 4⁰K to 2000⁰K by magnetic relaxation and anelastic techniques. The effects of trapping at impurities and lattice defects are being examined.

50. DEFORMATION OF \$ 24,000 01-02
 REINFORCED METALS
 M. Metzger

Mechanical microstrain behavior and dislocation distributions are being investigated in Cu and Cu matrix-W composite materials to provide relevant information for the design of technological composites. Etch pit studies, electron microscopy and tensile tests are the principal experimental techniques.

ILLINOIS, UNIVERSITY OF
Department of Metallurgy
and Mining Engineering -01- (Continued)

51. STUDY OF ACOUSTIC EMISSION \$ 46,000 01-02
 DURING THE PROPAGATION OF
 STRESS-CORROSION CRACKS
 E. Neville Pugh

The mechanism of stress corrosion cracking is under investigation. Primary attention is being given to the problem of whether crack propagation is a continuous or discontinuous process in Mg-Al alloys and Mg-Zn-Al alloys. Optical microscopy and the recording of acoustic emission during crack propagation are the principal experimental techniques.

52. NUCLEAR MAGNETIC RESONANCE \$ 67,000 01-02
 STUDIES
 T. J. Rowland

Magnetic resonance is used to study the precipitation hardening process in Cu-Be to investigate the diffusion of hydrogen in Nb, and to examine the details of molecular motion in rubber. Field ion microscopy is also used to examine the very fine precipitates in the Cu-Be alloys.

53. SOLID STATE PHASE \$122,000 01-02
 TRANSFORMATIONS AND
 THIN FILMS
 C. M. Wayman

Phase transformations, pre-transformation phenomena, nucleation and growth properties are studied in body-centered cubic metal thin films by electron microscopy. A new type of martensitic transition appears to occur in the Cu-Zn alloys and it has been shown that dislocations are the nucleation sites for shear type transformations in Cu-Au alloys.

54. PRECIPITATION IN \$ 29,000 01-02
 REFRACTORY METAL
 ALLOYS
 C. A. Wert

The solubility of hydrogen in V has been shown to be greatly influenced by the presence of other interstitial impurities like C, O, and N. The age hardening and strain aging of vanadium and tantalum containing carbon have been shown to contain at least four stages with the formation of a series of subcarbides. Electron microscopy and diffraction, tensile strength and microhardness measurements are the primary experimental techniques.

ILLINOIS, UNIVERSITY OF
Department of Physics -02- (Continued)

58. PROPERTIES OF NOBLE GAS CRYSTALS \$ 69,000 02-02
 R. O. Simmons

The properties of crystals of the rare gases helium, neon, argon and krypton are studied as examples of weakly bound crystals exhibiting quantum phenomena. The vacancy content of argon crystals has been measured and compared with theory and x-ray techniques used to determine the pressure-volume relationships. Observations and calculations have been made of the migration of voids in solid argon and neon as a result of the thermal gradients. Laser light scattering by these crystals is also being investigated.

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

A new nuclear magnetic resonance technique has been devised to probe the electronic wave function of conduction electrons in the neighborhood of a magnetic impurity in a non-magnetic crystal. The systems CuCo, CuNi, CuFe and CuV are being studied. Charge density oscillations in potassium as predicted by Overhauser are being sought by nuclear magnetic resonance and the many body theory of metals is being tested through measurement of the spin susceptibility of the conduction electrons in potassium at very high magnetic fields.

60. PHYSICS OF REFRACTORY MATERIALS \$ 62,000 02-02
 W. S. Williams

The ordering of random vacancies in vanadium has been followed through measurement of electrical resistivity. Dislocations in titanium carbide and silicon are being studied by the Lang x-ray technique. An attempt is being made to directly relate the atomic properties of the transition metal carbides to their performance in metal machining. The microstructure of dental enamel and its relation to caries is being studied as is the piezoelectric properties of bone.

61. RADIATION DAMAGE IN SOLIDS \$116,000 02-03
 J. S. Koehler

The effect of temperature on proton channeling in silver crystals has been measured. Electron diffraction techniques are being used to determine the structure of the lattice vacancy, the divacancy and clusters in gold. The effect of high energy electron irradiation on germanium and on the superconducting transition in lead are being studied.

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

Inorganic Materials Research Division

L. Brewer - Phone: 642-5176
 V. Zackay - Phone: 642-3812

62. THEORETICAL METALLURGY \$133,000 01-01
 J. W. Morris, Jr.

Development of microstructural theory of alloy plasticity for relation between mechanical properties and microstructure and theories on phase stability and kinetics of phase transformation for relation between microstructure and processing. Thermodynamics of inhomogeneous systems, pseudo-potential calculations of phase diagrams, kinetics of dislocation glide, dislocation-solute interactions for Ag and Cd in Zn, high temperature creep of Al, Pb, Sn, and Al-Mg, charpy impact testing of tough ferritic cryogenic alloys, structure and morphology of precipitates.

63. SUPERCONDUCTIVITY EFFECTS - HIGH \$113,000 01-02
 FIELD SUPERCONDUCTIVITY
 M. R. Pickus

Composites of thin filaments of brittle superconducting phase, Nb₃Sn or Nb-Zr, in a ductile Cu or Nb matrix are being fabricated by powder metallurgy.

64. FUNDAMENTALS OF ALLOY DESIGN \$235,000 01-01
 E. R. Parker, V. F. Zackay

Methods for designing iron base alloys for specific types of applications such as cryogenic, high temperature, or tough ultrahigh strength materials are being developed from the basic principles of materials science. Both theoretical and experimental methods are being used.

LAWRENCE BERKELEY LABORATORY
Inorganic Materials Research Division (Continued)

65. RELATION BETWEEN MICROSTRUCTURE AND PROPERTIES: ELECTRON MICROSCOPY AND DIFFRACTION
G. Thomas \$181,000 01-01

Structural investigations using electron microscopy and x-ray diffraction, control of properties in materials through characterization and control of structure, structural alloy steels, alloys undergoing spinodal and ordering transformations, oxide systems, toughness due to dislocated or twinned martensites in low alloy steels, mechanisms of order and substructure characterization in spinels and feldspars, in-situ radiation damage using the high voltage electron microscope. Materials studied: low alloy experimental steels; Cu-Ni-Fe, C-Mn-Al alloys, metastable Fe-Cr-Ni austenitic steels, cobalt and lithium ferrites, anorthites, aminoacids and other crystalline organic solids.

66. MICROSTRUCTURE AND BEHAVIOR OF CERAMIC MATERIALS: GLASS AND CERAMIC-METAL SYSTEMS
J. A. Pask \$149,000 01-01

The understanding of control of microstructure of ceramic materials through diffusion mechanisms and kinetics, high temperature reactions, and distribution of phases; the relationship of the microstructure to mechanical behavior at room and elevated temperatures; and measurements of diffusion in melts and rates of penetration of silicate melts into porous and polycrystalline compacts. The materials are primarily mullite, alumina, forsterite, spinel, and magnesia. The structural, thermodynamic and electrochemical character of glasses and ceramic-metal interfaces, and nature of electrochemical reactions at interfaces of metals and liquid glass.

67. HIGH TEMPERATURE REACTIONS
A. W. Searcy \$122,000 01-02

Equilibria and kinetics for vaporization and solid-gas reactions at high temperatures are studied. Fundamental concepts of surface and solution thermodynamics are being re-examined. Error due to preferential scattering of dimers in molecular beams has been established. Mass spectrometry and torsion effusion have been used to study vaporization of fluorides of Ga, Ce, and La and the incongruent vaporization of BaSO₄.

LAWRENCE BERKELEY LABORATORY
Inorganic Materials Research Division (Continued)

68. CRYSTAL IMPERFECTIONS \$142,000 01-01
 J. Washburn

Electron microscope investigations of defects resulting from ion implantation of phosphorous, arsenic and boron in silicon; atom probe field ion microscopy study of ion bombardment damage in irridium; scanning electron microscopy and transmission electron microscopy study of memory filaments in amorphous semiconductors; effect of surface layer composition and structure on work function for electron emission; properties of spectrally selective surface coatings for solar collectors.

69. RELATION OF MICROSTRUCTURE \$113,000 01-01
 TO PROPERTIES IN CERAMICS
 R. M. Fulrath

The effect of processing ceramics upon structural, ferroelectric, piezoelectric, and ferromagnetic properties; hot state scanning electron microscopic studies of sintering; defect structure, compositional width and sintering kinetics of $\text{PbZrO}_3\text{-PbTiO}_3$ and Li ferrite; sintering of Cu and Ni compacts, and sintering of UO_2 ; diffusion of He through fused SiO_2 and dense Al_2O_3 .

70. THERMODYNAMICS OF METAL SYSTEMS \$ 10,000 01-02
 L. Brewer, R. R. Hultgren

Compilations of selected values of the thermodynamic properties of the elements and of 400 binary alloy systems are in press.

71. COMPOSITE MATERIALS AND THEIR \$118,000 01-01
 ELECTRICAL AND MAGNETIC
 PROPERTIES AND MECHANICAL
 PROPERTIES
 R. H. Bragg

Structure, properties and kinetics of graphitization of glassy and pyrolytic carbon, structure of unidirectional solidified eutectics of Al-CuAl_2 and Al-Si . Small angle x-ray scattering and low temperature transport measurements.

LAWRENCE BERKELEY LABORATORY
Inorganic Materials Research Division (Continued)

72. POWDER METALLURGY \$ 67,000 01-01
M. R. Pickus

Using isostatic pressing, powder metallurgical techniques and alloy design criteria are being developed to produce ferrous alloys with near theoretical density and enhanced fracture toughness to minimize the degradation of mechanical properties by residual porosity.

73. THEORETICAL SOLID STATE PHYSICS \$ 16,000 02-02
M. L. Cohen

Pseudopotential calculations of the frequency and wave vector dielectric function for Si, charge density calculations for Si, Ge, Sn, GaAs, InAs, InSb, ZnSe, CdTe and Pb compounds, transition temperature of superconductors, properties of amorphous semiconductors, relationship between phonon softening of high transition temperature superconductors. X-ray photoelectron and uV photoelectron spectroscopy results were interpreted.

74. FAR INFRARED SPECTROSCOPY \$ 68,000 02-02
P. L. Richards

Far infrared spectroscopy in the $2\text{-}500\text{ cm}^{-1}$ range, Fourier spectroscopy, lasers, Fabry-Perot interferometers, cryogenic detectors, ac Josephson junctions, difference frequency generation and nonlinear spectroscopy using dye lasers, resonance modes in insulating antiferromagnetic alloys and radiation-damaged ruby, balloon-borne experiments to measure cosmic radiation. Bulk and surface resonance modes of antiferromagnets $(\text{Fe,Mn})\text{F}_2$ and $(\text{Co,Mn})\text{F}_2$, detection of trace impurities in germanium by high-resolution far infrared photoconductivity.

75. EXPERIMENTAL SOLID STATE PHYSICS \$133,000 02-02
AND QUANTUM ELECTRONICS
Y. R. Shen

Linear and nonlinear optical properties of material to obtain information about electronic band structure, phonon spectrum, electron-phonon interaction and other optical properties. Differential spectrometer, tunable dye laser Raman spectrometry, far infrared optical effects and far infrared generation by optical beating in magnetic crystals. Raman Brillouin and Rayleigh-Wing scattering of liquid crystals. Luminescence and wave-length-modulation spectroscopy.

LAWRENCE BERKELEY LABORATORY
Inorganic Materials Research Division (Continued)

76. SUPERCONDUCTIVITY, TUNNELING AND CRITICAL PHENOMENA \$ 54,000 02-02
 G. I. Rochlin

Josephson weak link devices, metal-oxide-metal tunnel junctions of Cu, Cr, V, tunnel junctions on Au and In using glow discharge in fluorocarbon vapors, quasiparticle lifetimes in superconductors and excitons in semiconductors using a pulsed laser technique.

77. RESEARCH ON SUPERCONDUCTORS AND SUPERCONDUCTING DEVICES \$ 71,000 02-02
 J. Clarke

Use of dilution refrigerator to estimate superconducting transition temperatures of metals such as Cu, Ag, Au, Mg, and Rh, whose transition temperatures lie far below experimentally obtainable temperatures, and also to investigate the transition temperatures of semiconductors such as SnTe, PbTe, and $Pb_xSn_yTe_z$. Use of superconductor-normal-superconductor and superconductor-insulator-normal junction bolometers as far infrared detectors, and of "hardened" Josephson devices for current amplification, and for measurement of tiny magnetic fields and voltages in geophysical and medical applications. Study and characterization of flicker noise in all types of electrical systems and devices.

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

78. LIQUID ACTINIDE METALS RESEARCH \$ 90,000 01-01
 L. J. Wittenberg, C. R. Hudgens

Characterization of the liquid state of actinide elements, U Pu Np, liquid viscosity, electrical and thermal conductivity, x-ray diffraction, thermal conductivities of La and Ce, viscosity of liquid Th, sound velocity in liquid Pu.

OAK RIDGE 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

79. DEFORMATION OF CRYSTALLINE SOLIDS \$105,000 01-01
R. O. Williams, R. W. Carpenter

Precipitation and fracture mechanisms in bcc alloys (Nb-Hf, Ta-W-Hf), thermodynamics and computer simulation of solid solution alloys, biaxial pole figures for representing preferred orientation, characterization of Al-Cu, Al-Si, and Al-Cu-Si alloys for studying radiation stability of precipitates at various stages of reaction.

80. METALLURGY OF SUPERCONDUCTING MATERIALS \$210,000 01-01
C. C. Koch, D. M. Kroeger,
D. S. Easton

Physical metallurgy of superconducting materials (Nb-Ti, Nb-O, Nb-Al, Nb-Al-Ge, W-Re, technetium alloys) analysis of techniques for ac loss and J_c measurements, models for flux pinning, low temperature specific heat determination, test of theoretical models for superconducting parameters.

81. PHYSICAL PROPERTY RESEARCH \$210,000 01-01
D. L. McElroy, T. G. Kollie,
R. K. Williams, J. P. Moore,
T. G. Godfrey

Physical property data on solids from 1.2 to 2600 K (thermal and electrical conductivity, thermopower, specific heat capacity, thermal expansion), determination of contributions from all transport mechanisms (phonon, electronic, etc.), effects of structure, refractory metals, poor conductors at high (T/θ_D) temperatures, effects of anion:cation mass ratio, graphite, irradiation effects, low and high temperature heat transport in UO_2 .

OAK RIDGE NATIONAL LABORATORY
Metals and Ceramics Division -01- (Continued)

82. FUNDAMENTAL CERAMICS \$210,000 01-01
G. P. Smith, J. Brynestad,
C. S. Yust

Dislocation and grain boundary structure by TEM in deformed polycrystalline UO_2 , stress relaxation in single crystalline UO_2 and CaF_2 , redox equilibria in liquid $UO_{2+x} - O_2$ systems, deformation of oxide films formed during oxidation of U alloys, optical spectroscopy of anion and cation vacancies in crystals, unusual oxidation states in non-metal crystals.

83. DIFFUSION IN SOLIDS \$146,000 01-02
T. S. Lundy, P. T. Carlson

Tracer diffusion in Fe-Cr-Ni alloys, anisotropic diffusion in TiO_2 , dislocation effects on U diffusion in UO_2 , concentration dependence of diffusion in V-Ti solid solutions, thermal gradient effects in NaCl and KCl, pressure effects on self diffusion in refractory metals, short circuit diffusion-bulk diffusion analyses.

84. THEORETICAL RESEARCH \$200,000 01-02
J. S. Faulkner, G. S. Painter,
W. H. Butler, W. A. Coghlan,
M. H. Yoo

Calculation of electronic states for clusters of atoms in solids, hybrid KKR-DVM band theory method applied to rubidium, niobium, and palladium, discrete variational method (DVM) developed for diamond, graphite, silicon carbide and titanium carbide, extension of coherent potential method for disordered systems, point defect-dislocation interactions involved in shrinkage of faulted vacancy loops, void formation in anisotropic metals, Auger transition energies, correlation functions for diffusion processes.

85. FUNDAMENTAL RESEARCH IN \$100,000 01-02
X-RAY DIFFRACTION
B. S. Borie, H. L. Yakel,
R. W. Hendricks, C. J. Sparks

Diffuse x-ray scattering measurements and interpretations for chemically and structurally ordered systems, thermally excited forbidden Bragg reflections, small angle x-ray scattering from irradiated Al and Al alloys, transformations in U alloys, generalized theory for structural transformations, structure of and effects of irradiation on boron carbides.

OAK RIDGE NATIONAL LABORATORY
Metals and Ceramics Division -01- (Continued)

86. SURFACE PHENOMENA \$174,000 01-01
J. V. Cathcart, R. E. Pawel

Oxidation mechanisms in U and Ta based alloys, stress generation and relaxation mechanisms and the role of mechanical properties of the metal and oxide in determining oxidation rate, diffusion of oxygen, partitioning of alloying elements between metal and oxide, theoretical treatment of diffusion-controlled reactions with moving interfaces.

87. FUNDAMENTAL PHYSICAL METALLURGY \$105,000 01-01
R. A. Vandermeer, J. C. Ogle

Structure and properties of high purity Al-base alloys, grain boundary structure and mobility, rolling and recrystallization textures of refractory metals, transformations in U-base alloys by dilatometry, x-ray diffraction, and optical microscopy.

88. RADIATION DAMAGE \$280,000 01-03
J. O. Stiegler, K. Farrell,
J. M. Leitnaker, E. E. Bloom

Void formation as function of temperature for neutron irradiated high-purity Al, Ni, and V, effect of solid transmutation products on mechanical properties, in situ electron radiation damage in HVEM, ion bombardment of Al, Ni, and V with self ions and self ions plus "transmutation products", swelling in high purity Fe-Cr-Ni alloy, effects of large amounts of gases on mechanical properties, theoretical treatment of nucleation and growth of voids, in situ measurement of effects of irradiation on mechanical properties.

OAK RIDGE NATIONAL LABORATORY

Solid State Division -02-

M. K. Wilkinson - Phone: 483-6713

89. RESEARCH AND DEVELOPMENT \$650,000 02-01
ON PURE MATERIALS

J. W. Cleland, G. W. Clark,
 C. B. Finch, J. C. Wilson,
 T. F. Connolly, R. E. Reed,
 F. J. Bruni, W. E. Brundage,
 R. D. Westbrook, C. C. Robinson

Purification, crystal growth, characterization and analysis of research materials; Research Materials Information Center: metal-metal oxide binary and ternary systems; hydrothermally grown quartz, LiNbO_3 , ZrSiO_4 , SrCl_2 ; arc-fusion growth of MgO , CaO , and SrO ; $\text{Ge}(\text{Li})$, $\text{Ge}(\text{HP})$, and HgI_2 radiation detector crystals; electron beam float zone growth of refractory V, Nb, and Zr, and Nb-Mo, Nb-Zr, and Nb-V alloys; single crystals of rare earths and rare earth alloys for neutron diffraction; large ferrite crystals for neutron beam switching.

90. SUPERCONDUCTIVITY \$115,000 02-02
S. T. Sekula, S. W. Schwenterly

Bulk magnetization measurements and low frequency magnetic permeability measurements of heavily irradiated single crystal V and Nb; a.c. permeability of Nb-Ti and Nb-Zr alloys; fast neutron damage in Nb-Ti and Nb-Mo.

91. NEUTRON SPECTROMETRY \$360,000 02-02
H. G. Smith, M. Nielsen,
H. A. Mook, R. M. Nicklow,
N. Wakabayashi

Inelastic neutron scattering from magnetic and nonmagnetic systems; critical scattering near chemical and magnetic phase transitions; small angle scattering; phonon dispersion curves of Tc, Au, NdSb, ZnTe; impurity phonon modes in Y(Tb) and Y(Ho) alloys; torsional modes in NH_4ClO_4 ; lattice dynamics of iodine; vibrational states in amorphous As_2Sc_3 ; spin wave spectra of Ni at high temperatures; spin wave dispersion and critical scattering in Dy; magnetic excitations in NdSb, PrN, TmN, TbN, ErN, YbN, TmAs; neutron scattering by voids in irradiated Al.

OAK RIDGE NATIONAL LABORATORY
Solid State Division -02- (Continued)

92. SPIN RESONANCE \$125,000 02-02
 M. M. Abraham, W. P. Unruh

EPR to study impurity centers and radiation induced defects in diamagnetic insulating crystals; defect structure and magnitude of local crystal fields; doping of alkaline earth oxides with alkali metals; magnetic resonance spectra of actinide isotopes in various fluorite-type hosts--ThO₂, SrCl₂, CaF₂, etc.; nature of S-state ions; ENDOR and EPR studies of V_{A2} and V centers.

93. NEUTRON DIFFRACTION \$430,000 02-02
 W. C. Koehler, J. W. Cable,
 H. R. Child, R. M. Moon

Elastic and inelastic scattering of polarized and unpolarized neutrons by magnetic systems; form factors and magnetic moment distributions in FeCo, iron-doped Ni₃Ga, Sm; magnetic form factors and magnetic susceptibilities of Gd₂O₃; neutron magnetic-disorder scattering from impurities in Fe; magnetic structures of Pm-Sm alloys, VF₃, Tb₂Y₁₋₂Sb alloys; critical scattering from Gd near its Curie point; polarized neutron study of magnetovibrational scattering in Fe.

94. DEFECT STRUCTURES IN NONMETALS \$320,000 02-02
 E. Sonder, Y. Chen,
 F. Modine, J. C. Pigg,
 O. E. Schow, L. C. Templeton

Optical absorption and emission and ESR studies of insulators related to defect structure; optical investigations of V⁻ center production by electron irradiation; f-center identification in KMgF₃ by optical absorption, EPR, and MCD techniques; energy stored in NaCl by ionizing radiation; optical and EPR investigations of Li₂BeF₄; luminescence of deformed alkaline earth oxide single crystals; "charge-transfer" transitions in doped insulating materials.

95. ION BOMBARDMENT \$ 60,000 02-03
 B. R. Appleton, O. E. Schow

Channeling behavior of high energy heavy ions in thin single crystals; 21.6 MV iodine ions hyperchanneled in Au and Ag; start-up of 2.5 MV PIAC facility; damage in metals produced by ion implanted gases; transverse energy changes in channeled ions; planar channeling and hyperchanneling; high energy heavy ion atomic physics.

OAK RIDGE NATIONAL LABORATORY
Solid State Division -02- (Continued)

96. X-RAY DIFFRACTION AND ELECTRON MICROSCOPY \$215,000 02-03
T. S. Noggle, S. M. Ohr,
J. M. Williams, B. C. Larson,
F. A. Sherrill, J. Narayan

Radiation damage in nearly perfect Cu crystals; anomalous x-ray transmission; diffuse scattering; Bragg reflection line widths and transmission electron microscopy; Lang topography of nickel ferrite crystals; strain fields due to precipitates in Cu-Co alloys; in situ radiation damage in graphite using electrons in TEM; single crystal films; theory of the interaction of electrons and x-rays with defects in solids.

97. THEORY AND COMPUTATIONS \$455,000 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

Radiation damage; lattice dynamics; magnetism; electronic structure of solids; computer simulation of radiation damage; standardization of displacement dose estimation procedures; cross sections for displacing atoms in solids by fast electrons; ion bombardment damage simulation; Monte Carlo channeling calculations; determination of nuclear lifetimes from blocking patterns; hyperchanneling; ferromagnetism in Ni; Stoner band calculations in Fe; Heisenberg spin systems; lattice vibrations in substitutionally disordered alloys in the coherent potential approximation; vibrational properties around substitutional impurities in insulators; electron screening and phonon spectra; crystal-field splittings in rare earth compounds; band structure calculations for rare-earth and actinide compounds.

98. SURFACE STUDIES ON METALS \$200,000 02-03
F. W. Young, Jr., L. H. Jenkins,
D. M. Zehner

LEED and Auger electron spectroscopy of Au and Ag films used in hyperchanneling studies; higher energy satellites in Auger spectra from Au, Ag, Mg, Be; thin oxide overlayers on Be and Mg substrates; secondary electron spectra; x-ray diffuse scattering from Co precipitates and defect clusters in Cu single crystals.

OAK RIDGE NATIONAL LABORATORY
Solid State Division -02- (Continued)

99. RADIATION EFFECTS AND ANELASTICITY IN METALS \$380,000 02-03
R. R. Coltman, C. E. Klabunde,
V. K. Paré, A. L. Southern,
J. K. Redman

Temperature dependence of fission neutron damage in Pt; elastic modulus measurements in thermal neutron irradiated Cu; anelasticity measurements in fast neutron irradiated Cu; fission neutron damage at less than 5°K in Cu, Al, V, Nb, Mo, Ta; density changes and resistivity measurements on fast neutron irradiated metals.

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

100. TRANSURANIUM PHYSICAL METALLURGY \$265,000 01-01
 RESEARCH
 R. D. Nelson, S. D. Dahlgren,
 M. D. Merz, R. P. Allen

Physical metallurgy of Pu and Np, sputter deposition of superconductors, effect of cathodic sputtering variables on T_c , H_c , and J_c , Nb-Al-Ge, structure of sputter deposited superconductors, transformations in Pu, deformation of high purity Pu, self-irradiation damage in Pu.

101. TRANSURANIUM CERAMICS RESEARCH \$ 65,000 01-02
 T. D. Chikalla, R. P. Turcotte

Solid state properties and thermodynamic behavior of transuranium ceramics, self-radiation damage, $^{238}\text{PuO}_2$, electrical conductivity, high temperature x-ray diffraction, Cm_2O_3 , Bk_2O_3 .

102. RADIATION EFFECTS ON METALS \$245,000 01-03
 J. L. Brimhall, H. E. Kissinger,
 E. Simonen

Study of production, migration, annihilation and coalescence of radiation produced defects in metals; neutron and heavy ion irradiations, Mo Nb Ni Re, yield strength, ductility, density, lattice parameter, electrical resistance, transmission electron microscopy, x-ray diffraction, mechanism of void formation and growth.

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 not be continued beyond the current contract period.



ARIZONA STATE UNIVERSITY

201. STUDY OF FERRITE FORMATION IN NEUTRON IRRADIATED AUSTENITIC STAINLESS STEELS \$ 27,312 01-03
 J. T. Stanley - Engineering Mechanics,
 Materials & Measurements Dept.

To determine the amount and distribution of ferrite in irradiated 316 stainless steel, effect of neutron fluence, irradiation temperature, composition, post-irradiation heat treatment, vibrating reed magnetometer measurements, electron microscopy.

ARIZONA, UNIVERSITY OF

202. IMPURITY DIFFUSION IN SOLIDS \$ 68,800 02-02
 C. T. Tomizuka - Dept. of Physics

Nature of diffusion-controlled phenomena in solids, application of high pressure techniques, conductivity measurements, activation volumes for self-diffusion in noble metals, Zn, Au-Ag alloys, electron mobility in solid He.

BROWN UNIVERSITY

203. A COMBINED MACROSCOPIC AND MICROSCOPIC APPROACH \$ 80,000 01-01
 J. Gurland and J. R. Rice, Division
 of Engineering

Study of cleavage fracture and fracture toughness of carbon steels influenced by microstructure, theory of ductile fracture, strain hardening and ductility as a function of microstructure, influence of second phase on fatigue strength, creep-rupture models.

CALIFORNIA INSTITUTE OF TECHNOLOGY

204. STUDIES OF ALLOY STRUCTURES AND PROPERTIES \$259,000 01-02
 P. Duwez and C. C. Tsuei - Division
 of Engineering and Applied Science

Study of the structure and properties of metastable alloys obtained by rapid cooling from the melt with emphasis on amorphous alloys, copper-base superconductors, electrical resistivity, magnetoresistance, thermoelectric power, Curie temperature, ferromagnetic resonance, Mössbauer spectroscopy, amorphous-crystalline transformation kinetics.

CALIFORNIA INSTITUTE OF TECHNOLOGY (Continued)

205. DISLOCATION MOBILITY AND DENSITY IN METALLIC CRYSTALS \$ 65,000 01-01
 T. Vreeland, Jr. - Division of Engineering and Applied Science

Direct observation of stress induced dislocation displacements with Berg-Barrett and etch pit methods, Zn, Cu, Pb, Mo single crystals, dislocation interactions with irradiation induced defects, thermal phonons, conduction electrons, and lattice periodicity, transmission electron microscopy.

CALIFORNIA, UNIVERSITY OF

206. PARTICLE SIZE DISTRIBUTION EFFECTS IN PRECIPITATION HARDENING \$ 62,000 01-01
 A. J. Ardell - Materials Dept., Los Angeles

Effects of bimodal distributions and sinusoidal aging in Ni-Al alloys, effect of precipitation on void formation in proton irradiated Ni alloys, theoretical research on proton range in materials containing voids.

207. FOURIER SPACE COMPUTER SIMULATION OF CRYSTALLINE IMPERFECTIONS \$ 29,000 01-02
 D. de Fontaine - Materials Dept., Los Angeles

Development of computer programs for elastic interaction energy calculations of crystalline defects, computer calculations for solid state transformations, models for quantitative studies of extended groups of interacting defects in crystals.

208. ELECTRIC AND MAGNETIC PROPERTIES OF TRANSITION METALS AND THEIR COMPOUNDS \$ 63,580 02-02
 A. W. Lawson - Dept. of Physics, Riverside

Magnetization measured under uniaxial applied stress, magneto-elastic energy and field induced magnetic phases, EuTe, EuSe, purification and growth of single crystals of GdN and DySb, magnetization and resonance measurements, linewidth in CrCl₃, EuS, EuSe, standing wave resonance determinations in doped EuO.

CALIFORNIA, UNIVERSITY OF (Continued)

209. NEW MATERIALS BY LOW TEMPERATURE CONDENSATION \$ 90,000 01-01

Huey-Lin Luo - Dept. of Applied
Physics and Information Science,
San Diego

Sputtering technique applied to superconducting materials, molybdenum-sulfide complexes, magnetic alloys with Ag, amorphous materials, carbon sputtering as a surface coating.

210. RESEARCH ON THE PROPERTIES OF MATERIALS AT VERY LOW TEMPERATURE \$162,438 02-02

J. C. Wheatley - Dept. of Physics,
San Diego

Properties of liquid and solid ^3He in the millidegree range, magnetic, thermal, sonic, superfluid properties, measurements along the melting curve, cooling ^3He via magnetic energy coupling, applications of noise thermometry, magnetic coupling measurements in ^3He -Pt, magnetic fluctuations.

CARNEGIE-MELON UNIVERSITY

211. OPTICAL AND MICROWAVE SPECTROSCOPY OF Np AND Co IN SCHEELITES AND OTHER CRYSTALLINE ENVIRONMENTS \$ 30,395 02-02

J. O. Artman - Dept. of Physics
and Electrical Engineering

Crystal growth of Np-doped CaF_2 , optical absorption spectra, effects of Li additions as a charge compensator, Mössbauer effect spectroscopy crystal field interaction parameters.

CASE WESTERN RESERVE UNIVERSITY

212. MOTION OF IONS IN SOLID HELIUM \$ 37,360 02-02

A. J. Dahm - Dept. of Physics

Structure and motion of positive ions and negatively charged voids in solid helium, mobility measurements, calculations on electron tunneling from voids in strong electric fields, EPR of electrons trapped in voids, lifetime measurements of orthopositronium trapped in voids.

CASE WESTERN RESERVE UNIVERSITY (Continued)

213. DISLOCATION-SOLUTE ATOM INTERACTIONS \$ 42,000 01-01
 IN ALLOYS
 R. Gibala - Div. of Metallurgy
 and Materials Science

Carbon-vacancy interactions influencing anelasticity, strength and strain aging of austenite, interstitial and substitutional solute hardening and softening and the effect of solute partitioning on strengthening of Nb, effects of solute gradients on strengthening of materials, hydrogen embrittlement in refractory metal alloys, internal friction, mechanical properties and electron microscopy techniques.

214. SOLID STATE PHYSICS \$ 83,000 02-02
 R. W. Hoffman - Dept. of Physics

Structure-property relationships for intrinsic stress, magnetization, and adhesion in thin metallic films, dielectric and cohesive properties of insulators, pressure, temperature and frequency dependence, spin wave calculations of amorphous ferromagnets, dielectric constant measurements of MgO, Al₂O₃, fused silica and single crystal quartz.

215. EXPERIMENTS IN HIGH VOLTAGE \$ 55,000 01-03
 ELECTRON MICROSCOPY
 T. E. Mitchell - Div. of Metallurgy
 and Materials Science

High resolution selected area diffraction and in-situ radiation damage studies using high voltage electron microscopy, radiation damage in Cu stainless steel Ni V graphite and quartz, radiation induced precipitation of carbides in stainless steel, crystalline to amorphous transformation of quartz under electron irradiation.

CHICAGO, UNIVERSITY OF

216. THE STUDY OF PHONONS IN AMORPHOUS AND \$ 40,000 02-02
 CRYSTALLINE SOLIDS
 S. A. Solin - Dept. of Physics

Spontaneous and resonance Raman spectroscopy, optic phonons in RbClO₃, piezo Raman effect of electronic impurity levels in Ge and Si, Raman spectra in amorphous As₂S₃, liquid nitrogen cooled laser employing YAG:Nd or YAG:Ho laser rods.

CINCINNATI, UNIVERSITY OF

217. RADIATION EFFECTS IN BCC REFRACTORY METALS AND ALLOYS \$ 45,000 01-03
 J. Moteff - Dept. of Materials
 Science & Metallurgical Engineering

Defect state in refractory metals W, Mo, Nb, irradiated with neutrons at high temperatures, transmission electron microscopy, resistivity, microhardness, dilatometry, bulk density, isochronal annealing studies to determine thermal stability and recovery kinetics.

CLARKSON COLLEGE OF TECHNOLOGY

218. NUCLEATION OF VOIDS \$ 14,770 01-03
 J. L. Katz - Dept. of Chemical Engineering (16 mos.)

Theoretical study of the rates of void nucleation and loop nucleation in metals, vacancies and interstitials are present in arbitrary supersaturations, effects of nucleating agents such as insoluble gas and stress, applications to void formation in neutron irradiated materials.

COLORADO SCHOOL OF MINES

219. LIQUID LITHIUM CORROSION AND CORROSION-FATIGUE RESEARCH \$ 32,000 01-01
 D. L. Olson and W. L. Bradley -
 Dept. of Metallurgical Engineering

Corrosion and corrosion-fatigue of stainless steels in liquid lithium, techniques of grain boundary grooving and relaxation of sinusoidal surface profile, weight loss techniques, mechanical behavior in liquid lithium, mechanisms of dissolution.

COLORADO, UNIVERSITY OF

220. CRITICAL SCATTERING OF LASER LIGHT BY THIN FLUID FILMS \$ 40,471 02-02
 R. Mockler and W. O'Sullivan - Dept. of Physics and Astrophysics

Study of critical phenomena in thin fluid films and boundary layers, techniques of internal reflection spectroscopy and close spaced Fabry-Perot spectroscopy, studies of light scattered from Brownian particles suspended in a critical mixture, effects of surface fluid interactions near critical points.

CONNECTICUT, UNIVERSITY OF

221. ELECTRON-DISLOCATION INTERACTIONS \$ 32,000 01-01
 AT LOW TEMPERATURES
 J. M. Galligan - Dept. of
 Metallurgy

Measurements of the stress for plastic deformation in various superconducting materials as a function of the density of superconducting electrons, mobile dislocation density involved in plastic deformation, interactions of electrons with moving dislocations.

222. CLUSTER CARBURIZING \$ 34,146 01-01
 J. E. Morral - Dept. of Metallurgy
 and Inst. of Materials Science

Carburizing of age hardened materials, formation of finely dispersed carbide phase when the aged precipitate cluster is a strong carbide former, bulk and thin specimens of Ta-Hf and Nb-Hf alloys, density measurements, electron microscopy and electron diffraction.

CORNELL UNIVERSITY

223. DEFECTS IN METAL CRYSTALS \$208,000 01-03
 R. W. Balluffi and D. N. Seidman -
 Dept. of Materials Science and
 Engineering

Field ion microscope studies of self-interstitials, FIM and electrical resistivity studies of vacancies, FIM studies of solute atoms in dilute alloys, application of atom probe FIM to point defect studies, computer simulation of contrast effects produced by defects in FIM specimens, role of impurity gases in the formation of FIM artifacts, direct measurement of the range of a focussed collision replacement sequence, atomic structure of grain boundaries.

224. EFFECT OF ENVIRONMENT ON FRACTURE \$ 32,489 01-01
 BEHAVIOR
 H. H. Johnson - Dept. of Materials
 Science and Engineering

Hydrogen trapping in Fe and steels, permeation measurements, determination of the trapping sites in cold worked Fe, temperature dependence of trapping parameters, stress corrosion phenomena.

CORNELL UNIVERSITY (Continued)

225. A STUDY OF THE INTERACTION BETWEEN MAGNETIC FLUXOIDS AND CRYSTAL DEFECTS IN TYPE II SUPERCONDUCTORS \$ 34,032 01-02
E. J. Kramer - Dept. of Materials
Science and Engineering

Measurements of flux line lattice pinning by dislocation loops introduced by fast neutron and ion bombardment of Nb and Nb alloys, critical currents and pinning force densities, effect of defect density and size on the peak in the pinning force density as a function of magnetic field, new model of flux pinning in hard superconductors.

226. THEORY OF STRUCTURE AND DYNAMICS IN CONDENSED MATTER \$ 60,000 02-02
J. A. Krumhansl - Dept. of Physics,
Laboratory of Atomic and Solid
State Physics

Theory of quantum and classical lattice excitations in condensed matter, electrical, thermal and optical properties, studies of highly anharmonic solids, excitations in disordered systems transport involving phonons, computer studies of liquids, soft modes.

227. GRAIN BOUNDARY SLIDING AND STRUCTURE \$ 36,000 01-01
Che-Yu Li - Dept. of Materials
Science and Engineering

Stress dependence of grain boundary sliding, contribution of grain boundary sliding to deformation of polycrystalline solids, mechanism of grain boundary sliding, mechanical equation of state of polycrystalline solids at elevated temperatures, Pb single crystals, bicrystals and polycrystalline specimens.

228. EXPERIMENTAL PHONON PHYSICS \$136,000 02-02
R. O. Pohl and A. J. Sievers -
Dept. of Physics, Laboratory of
Atomic and Solid State Physics

Lattice vibrations in non-crystalline powders, low temperature specific heat, thermal conductivity, far infrared absorption, heat pulse propagation, hydrostatic pressure dependence of near and far infrared lattice absorption in crystals with lattice defects, surface resistance of Pb, far infrared properties of Bi single crystals, development of a new source for the far infrared spectral region.

CORNELL UNIVERSITY (Continued)

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

First and second pressure derivatives of the elastic constants for NaCl and Na, combined length - ultrasonic transit time system, elastic constants and pressure derivatives for CsCl, pressure dependence of elastic limit and stress-strain curves of Na ultrafine grained carbides and lamellar superconductors.

230. SOLID STATE PHYSICS: \$130,800 02-02
MAGNETIC PHENOMENA
R. H. Silsbee and R. Bowers - Dept. of Physics

Microwave resonance in insulating materials containing orientable defects and in dilute alloys of magnetic ions in ion magnetic host metals, piezoelectric resonance pulse experiments in KCl:Li, ESR of rare earth impurities in Al and of Co in Al and Cu, transport properties in metals, nonlocal electromagnetic generation of acoustic waves in metals, magnetothermal conductivity measurements, radio-frequency surface impedance measurements.

DARTMOUTH COLLEGE

231. THEORY OF ELECTRON-PHONON SCATTERING EFFECTS IN METALS \$ 15,318 02-02
W. E. Lawrence - Dept. of Physics and Astronomy

Theoretical study of electron-phonon scattering anisotropy in metals, effects of scattering anisotropy on magnetoresistivity, deviations from Matthiessen's rule, anisotropy in the electronic mass enhancement, and superconducting gap anisotropy, to develop soluble models for the relaxation time.

232. STUDIES OF ELECTRICAL CONDUCTION IN METALS \$ 28,503 02-02
J. R. Merrill - Dept. of Physics and Astronomy

Magneto plasma wave propagation, radiofrequency size effect, tunneling phenomena, d.c. and helicon measurements of magnetoresistivity and temperature dependence of electrical resistivity.

DARTMOUTH COLLEGE (Continued)

233. EXPERIMENTAL DETERMINATION OF THE TEMPERATURE DEPENDENCE OF METALLIC WORK FUNCTIONS AT LOW TEMPERATURES \$ 22,903 02-02
P. B. Pipes - Dept. of Physics and Astronomy

Temperature dependence of work functions in metals at low temperatures, application of a low frequency temperature gradient to the sample and measurement of the variation of the work function electrostatically, Nb Pb Cu, effects of the superconducting transition.

FLORIDA, UNIVERSITY OF

234. QUANTITATIVE ANALYSIS OF SOLUTE SEGREGATION IN ALLOYS BY TRANSMISSION ELECTRON MICROSCOPY \$ 38,000 01-02
J. J. Hren and C. S. Hartley - Dept. of Metallurgical and Materials Engineering

Simulation of two-beam transmission electron microscope images of crystalline defects using digital computer printout, theoretical models for images of solute distributed along dislocations and stacking faults, development of anisotropic solutions to a general force dipole array to be used as more accurate models for linear and planar defects, experimental dislocation images of Al-0.84% Cu.

235. DEFORMATION PROCESSES IN REFRACTORY METALS \$ 33,000 01-01
R. E. Reed-Hill - Dept. of Materials Science and Eng.

Effects of dynamic strain aging, dynamic recovery and mechanical twinning on the mechanical properties of Ti Zr and Nb, tensile tests, quantitative optical and electron microscopy, stress-strain curve analysis, work hardening rate, yield stress, total and uniform elongations, strain rate sensitivity, twin volume fraction.

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 metal single crystals of Ga In Al Zn Pb, heat capacity, a.c. susceptibility, d.c. magnetization, electron tunneling properties of normal and superconducting metals, properties of fast frozen Ga-In alloys.

GEORGIA INSTITUTE OF TECHNOLOGY

237. A STUDY OF THE STRUCTURE AND MECHANICAL PROPERTIES OF ORDERED ALLOYS \$ 37,000 01-01
B. G. LeFevre and E. A. Starke, Jr. -
School of Chemical Engineering

Relationship between microstructure and mechanical properties of ordered Ni₄Mo and CuPt, measurements of long-range order, domain size, internal strains, deformation modes, ordering kinetics and mechanisms, atomic arrangements, quantitative influence of microstructural features on yield strength, work hardening and fracture initiation.

HAWAII, UNIVERSITY OF

238. PHOTOELECTRIC EMISSION FROM THIN FILMS IN THE VACUUM ULTRAVIOLET REGION \$ 25,844 02-02
W. Pong - Dept. of Physics
and Astronomy

Photoelectric properties of thin solid films of Cs-halides, Cu phthalocyanine, alkali halides, photoemission measurements, density-of-states structure, properties of ultra-thin metal films on insulating substrates, inelastic scattering of electrons, properties of thin amorphous niobium-oxide films.

239. RADIATION DAMAGE IN OPTICALLY TRANSPARENT MATERIALS (ZIRCONS) \$ 20,000 02-03
A. N. Thorpe - Dept. of Physics

Infrared and EPR measurements on irradiated zircon, natural alpha particle, gamma irradiation and neutron induced fission, low temperature magnetic properties, magnetic susceptibility measurements to determine the effect of irradiation on the crystal fields of magnetic impurities.

ILLINOIS INSTITUTE OF TECHNOLOGY

240. THE STRENGTHENING AND TOUGHENING OF BRITTLE MATERIALS \$ 32,000 01-01
L. J. Broutman - Dept. of Metal-
lurgical and Materials Engineering

Effect of spherical and fibrous particle additions on the strength and toughness of brittle materials, inorganic glasses, glass fibers in single crystal K titanate, strength determinations and fracture toughness measurements as a function of fiber volume fraction, interface treatment and length to diameter ratio.

241. THERMAL MEASUREMENTS ON SOLIDS \$ 65,094 02-02
BELOW 1°K
H. Weinstock - Dept. of Physics

Low temperature thermal conductivity and specific heat measurements to study defects produced by neutron irradiation on MgO and pyrolytic graphite, electrical resistivity studies of ion irradiated amorphous carbon films, thermal conductivity of superconducting V Pb-Tl alloys and Pb films, thermal and electrical conductivity measurements on Kondo alloys of Cu containing less than 0.1% Fe and Cr impurities.

JOHNS HOPKINS UNIVERSITY

242. ACOUSTIC EMISSION AND THE PORTEVIN-LE CHATELIER EFFECT \$ 32,000 01-01
W. F. Hartman - Dept. of
Mechanics & Materials Science

Correlation of acoustic emission during discontinuous yielding of FCC metals and alloys with Luder's band propagation, parabolic strain-hardening transitions, grain boundaries and temperature effects, to identify the acoustic emission sources and to establish acoustic emission monitoring as an aid to studying metallurgical phenomena.

LEHIGH UNIVERSITY

243. FORMING OF COMPOSITE MATERIALS \$ 28,000 01-01
B. Avitzur - Dept. of Metallurgy
and Materials Science

To delineate the conditions for preparing multifilament Nb-44% Ti superconductor in an Al matrix understanding the coprocessing of hard and soft materials.

MARQUETTE UNIVERSITY

244. DEFECT STRUCTURES IN NON-STOICHIOMETRIC OXIDES \$ 35,964 01-02
R. N. Blumenthal - Dept. of
Mechanical Engineering

Electrical conductivity, Hall mobility, ionic transference and thermogravimetric weight measurements as a function of oxygen partial pressure, oxygen nonstoichiometry, dopant concentration and temperature, CeO₂, CaO-doped CeO₂, to determine the defect structure and transport properties of defects in pure and doped nonstoichiometric oxides from their thermodynamic and electrical behavior.

MARYLAND, UNIVERSITY OF

245. AN INVESTIGATION OF IRRADIATION STRENGTHENING OF BCC METALS AND SOLID SOLUTIONS \$ 45,000 01-03
R. J. Arsenault - Dept. of
Chemical Engineering

Effects of neutron or proton damage on the rate controlling mechanism for low temperature plastic deformation, activation parameters for deformation of BCC metals and solid solutions, Mo V, post-irradiation anneal hardening of V, computer simulation of thermally activated dislocation motion through a random array of obstacles.

246. THE GALVANOMAGNETIC PROPERTIES OF GRAPHITE IN THE TEMPERATURE RANGE 4-300°K AND PRESSURE RANGE 0-10,000 BARS \$ 30,384 01-01
I. L. Spain - Dept. of
Chemical Engineering

Galvanomagnetic effects in graphite in fields up to 200 kg with emphasis on neutron irradiation effects and high pressure using Shubnikov de Haas oscillations, calculations of galvanomagnetic coefficients, crystal structure and low temperature electronic properties of C₆K, c-axis elastic parameters.

MARYLAND, UNIVERSITY OF (Continued)

247. ALLOY STRENGTHENING DUE TO ATOMIC ORDER \$ 38,000 01-02
M. J. Marcinkowski - Dept. of Mechanical Engineering

Theoretical and experimental research on strengthening in ordered and disordered alloys, Fe-Co, Fe-Al, yield behavior, work hardening, fracture, electron microscopy, theoretical models for deformation modes.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

248. LOW TEMPERATURE AND NEUTRON PHYSICS STUDIES \$129,742 02-02
C. G. Shull - Dept. of Physics

Polarized neutron scattering on Bi at high magnetic field to obtain information about the induced diamagnetic structure and the electron distribution responsible for the anomalously high susceptibility, search for de Haas Van Alphen quantum oscillatory effects, polarized neutron scattering by nuclear-polarized systems.

249. THERMAL NEUTRON SCATTERING STUDIES OF MOLECULAR DYNAMICS AND CRITICAL PHENOMENA IN FLUIDS AND SOLIDS \$ 88,000 02-02
S. H. Chen and S. Yip - Dept. of Nuclear Engineering

Triple axis neutron spectrometer at MIT research reactor to study molecular dynamics in gases and liquids, metastable supercooled state of Ga, critical scattering from Li-Ga and Li-Na binary liquid mixtures, He-Xe gas-gas phase separation at high pressure, pressure derivative of incoherent scattering law for hydrogen gas at high densities, diffusion in mixed gases at high pressure and coherent scattering of ^{36}Ar gas at moderate densities.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY (Continued)

250. BASIC RESEARCH IN CRYSTALLINE AND NONCRYSTALLINE CERAMIC SYSTEMS \$280,000 01-01
 W. D. Kingery and R. L. Coble -
 Dept. of Metallurgy and
 Materials Science

Defect structures, defect mobilities, atomic transport, sintering, effects of thermal gradients on nonstoichiometric oxide solid solutions of (U, Ce)-O₂, particle size distribution effects in sintering, chemical vapor deposition method for preparation of specimens, activated sintering of UO₂ by proton bombardment, grain boundaries in ceramics.

MASSACHUSETTS, UNIVERSITY OF

251. ULTRASONIC ATTENUATION STUDIES OF THE ELECTRONIC STRUCTURE OF METALS \$ 41,045
 A. R. Hoffman - Dept. of Physics
 and Astronomy

Thermal conductivity of single crystal Be, continuous-wave spectrometer measurement of sound velocity variations at the superconducting temperature of Al, pulse-echo magnetoacoustic determination of caliper dimensions of Be Fermi surface, pulse-echo ultrasonic attenuation measurements in Nb to study bulk trapping mechanisms for fluxoids in the mixed state.

MICHIGAN STATE UNIVERSITY

252. PROPERTIES OF RARE GAS SOLIDS \$ 41,768 02-02
 G. L. Pollack - Dept. of Physics

Thermal conductivity of single crystals of A, N₂, O₂, He-II film flow into and out of solid A beakers, theory of Kapitza resistance between a solid and He-II, surface waves, phonon interactions.

MICHIGAN TECHNOLOGICAL UNIVERSITY

253. STRUCTURE AND PROPERTIES OF SOLID SOLUTIONS \$ 40,175 01-01
 A. A. Hendrickson and D. A. Koss -
 Dept. of Metallurgical Engineering

Interaction between substitutional solute atoms and mobile dislocations, serrated yielding in FCC substitutional solid solutions, temperature and strain rate dependence of the critical strain and activation energies, solid solution hardening in binary and ternary BCC alloys, Nb-Ta, Nb-W, Nb-Hf, Nb-W-Mo.

254. EFFECT OF ANNEALING ON THE SUBSTRUCTURE OF COLD WORKED FCC METALS AND ALLOYS \$ 32,863 01-02
 D. E. Mikkola - Dept. of
 Metallurgical Engineering

Quantitative study of structural changes due to annealing, x-ray diffraction and transmission electron microscopy, Cu, Cu-base alloys, annealing of stacking faults, kinetics of ordering and antiphase domain growth.

255. A STUDY OF GRAIN BOUNDARY SEGREGATION USING THE AUGER ELECTRON EMISSION TECHNIQUE \$ 45,085 01-01
 D. F. Stein - Dept. of
 Metallurgical Engineering

Grain boundary fracture strength influenced by segregation, corrosion susceptibility, grain boundary hardening, stainless steel, high temperature creep rupture in nickel-base superalloys, grain boundary hardening in Al_2O_3 , role of Cu in Fe-base alloy embrittlement.

256. EXPERIMENTAL AND THEORETICAL STUDIES IN SOLID STATE AND LOW TEMPERATURE PHYSICS \$165,736 02-02
 A. M. Goldman, L. H. Nosanow,
 W. V. Weyhmann, and W. Zimmerman, Jr. -
 Dept. of Physics

Superconductivity, theoretical research on quantum liquids and crystals, magnetism, experiments on liquid and solid helium, pair-field susceptibility of superconductors, heat capacity of superconducting films in the critical region, exchange in solid 3He , solid mixtures of 3He and 4He , nuclear resonance and orientation studies of magnetic properties, Kondo effect, cooling to millikelvin temperatures using enhanced hyperfine nuclear cooling, quantized circulation in superfluid 4He .

MINNESOTA, UNIVERSITY OF

257. "IN-SITU" ELECTRON MICROSCOPE \$ 38,000 01-01
INVESTIGATION OF THE NUCLEATION
AND GROWTH OF SPUTTERED THIN FILMS
T. E. Hutchinson - Dept. of Chemical
Engineering and Materials Science

Mechanism of film growth, role of adatom energy on film nucleation, thin single crystal silicon substrates, Ag and Si deposits.

258. ANALYSIS OF THE DUCTILE-BRITTLE \$ 33,780 01-01
TRANSITION TEMPERATURE IN Fe-
BINARY ALLOYS
W. W. Gerberich - Dept. of Chemical
Engineering and Materials Science

Effects of solute atom size, metallic bonding, concentration, dislocation dynamics, acoustic emission techniques employed to analyze the number of non-propagating cleavage microcracks occurring prior to crack instability, Fe-base binary alloys.

MONTANA STATE UNIVERSITY

259. HIGH-TEMPERATURE OXIDATION \$ 28,960 01-01
OF IRIIDIUM
R. T. Wimber - Dept. of
Mechanical Engineering

Oxidation of iridium at temperatures in the range 1600-2200°C, self-resistance heated wires in oxygen atmospheres of 0.05-1000 torr, standard state entropies and enthalpies for formation of IrO₂ and IrO₃, correlation of measured surface recession rates with theoretically predicted rates.

NEW YORK, STATE UNIVERSITY OF

260. SLIP INITIATION AND MICRODYNAMICS \$ 45,000 01-01
OF PLASTIC FLOW

J. C. Bilello - Dept. of
Materials Science, Stony Brook

Role of interstitial impurities and slip asymmetry on the microdynamics of dislocations in tungsten, concentration effects in Cu base solid solutions and the effect of random localized obstacles on mobile dislocation interactions, dislocation microdynamics in polycrystalline BCC metals, applications neutron inelastic scattering and lattice mechanics to problems concerned with the fracture behavior and linear defects in BCC metals, microstrain techniques, etch-pit observations, scanning electron microscopy.

261. THEORY OF REACTION KINETICS \$ 40,000 02-03

J. W. Corbett and D. Peak -
Dept. of Physics, Albany

Role of spatial correlation between reacting species on their reaction kinetics, techniques for handling recovery in discrete and continuum lattices, applications to radiation damage, radiation damage, radiation chemistry, photochemistry, ionization yields, precipitation development of a molecular theory of nucleation and precipitation.

262. FATIGUE-ENHANCEMENT OF DIFFUSION \$ 12,050 01-01

H. Herman - Dept. of Materials
Science, Stony Brook

Fatigue enhanced diffusion in alpha-brass using electrical resistivity to measure increases in short range order, fatigue-generated excess vacancies, cryogenic low-amplitude mechanical cycling, ordering kinetics.

NORTH CAROLINA STATE UNIVERSITY

263. DIFFUSION OF GASES IN SOLIDS \$ 36,286 01-03

T. S. Elleman - Dept. of
Nuclear Engineering

Migration of tritium through stainless steel and zircaloy, migration of inert gases through UO₂, effect of oxide films on zircaloy as barrier to tritium release, tritium trapping in stainless steel and zircaloy, tritium diffusion in zircaloy.

NORTH CAROLINA, UNIVERSITY OF

264. INVESTIGATION OF DEFECT STRUCTURES \$ 30,922 02-02
BY ELECTRIC POLARIZATION AND
RELAXATION METHODS

J. H. Crawford, Jr. - Dept. of Physics

Dielectric relaxation, of reorientable dipoles in solids, impurity, vacancy and impurity-interstitial dipoles in alkali halides and alkaline earth halides, ionic thermoconductivity, electron spin resonance, optical absorption, emission spectra, infrared spectra.

265. PRESSURE VARIATION OF SINGLE \$ 20,387 02-02
CRYSTAL ELASTIC CONSTANTS

C. S. Smith - Dept. of Physics

Single crystal elastic constants for LiH at 295 K and 80 K, pressure and temperature derivatives, equation of state and specific heat information.

NORTHWESTERN UNIVERSITY

266. EFFECT OF POINT DEFECTS ON \$ 47,000 01-03
MECHANICAL PROPERTIES OF METALS

M. Meshii - Dept. of Materials Science

Effect of interstitial atoms produced by electron irradiation, effect of lattice vacancies produced by rapid quenching, interactions between dislocations and point defects, strength, yielding, stress-strain behavior, Fe, Nb.

OKLAHOMA, UNIVERSITY OF

267. THERMOELECTRIC SIZE EFFECT IN \$ 29,956 02-02
NOBLE METALS

R. R. Bourassa - Dept. of Physics
and Astronomy

Thermoelectric size effect in noble metals (Au Ag Cu) thermopower vacancies in Al, thermopower of In alloys.

OREGON STATE UNIVERSITY

268. NATURAL CONVECTION HEAT TRANSFER \$ 21,696 01-01
 IN LIQUID METALS
 J. R. Welty - Dept. of Mechanical
 and Nuclear Engineering

Study of natural convection phenomena in low Prandtl number fluids (Hg), vertical surfaces with constant wall temperature and constant heat flux, measurements of local velocity and temperatures.

PENNSYLVANIA STATE UNIVERSITY

269. CERAMIC RESEARCH \$ 28,053 01-01
 R. C. Bradt and J. H. Hoke -
 Dept. of Material Sciences

Superplastic behavior in ceramic Bi_2O_3 systems, isothermal and transformational superplasticity, pure Bi_2O_3 and $\text{Bi}_2\text{O}_3\text{-Sm}_2\text{O}_3$ eutectoid, effects of stoichiometry on the fracture of wustite, fracture initiation and propagation in wustite as a function of temperature and microstructure.

PENNSYLVANIA, UNIVERSITY OF

270. DISLOCATION MOBILITIES IN \$ 33,383 01-01
 ORDERED ALLOYS
 D. P. Pope - Dept. of Metallurgy
 and Materials Science

Dislocation velocities in ordered alloys (Cu_3Au), correlation of dislocation properties with gross mechanical behavior, dislocation slip band observations, application of stress pulses to single crystals.

PITTSBURGH, UNIVERSITY OF

271. THERMAL, STRUCTURAL AND MAGNETIC \$ 95,240 02-02
STUDIES OF METALS AND INTERMETALLIC
COMPOUNDS
W. E. Wallace and R. S. Craig -
Dept. of Chemistry

Solubility of hydrogen in rare earth intermetallics (lanthanide-nickel or cobalt), electrical, magnetic and crystallographic characteristics of rare earth intermetallics containing dissolved hydrogen, heat capacity measurements on intermetallic compounds, magnetic properties of rare earth-transition metal intermetallics.

PURDUE UNIVERSITY

272. TRANSPORT AND THERMODYNAMIC \$ 38,000 01-02
PROPERTIES OF SOLIDS
R. E. Grace - School of Materials
Science & Metallurgical Engineering

Atomic diffusion, lattice defects, interfacial reactions in solid multicomponent alloys and intermetallic compounds, vapor-solid and solid-solid diffusion couples in Ag-Zn, Ni-Al, Fe-Ni-Al and Cu-Zn-Ni, stability of planar interfaces, electron microprobe and scanning electron microscopy.

RENSSELAER POLYTECHNIC INSTITUTE

273. FATIGUE BEHAVIOR OF BCC METALS \$ 28,700 01-01
N. S. Stoloff - Dept. of
Materials Engineering

Cyclic deformation in high purity V, high cycle fatigue in polycrystalline V, optical and electron microscopy, hydrogen embrittlement of Hf, relationship between microstructure and deformation and fracture properties.

ROCHESTER, UNIVERSITY OF

274. DIFFUSIONAL CREEP OF MULTI-COMPONENT SYSTEMS \$ 27,000 01-01
J. C. M. Li - Dept. of Mechanical and Aerospace Sciences

Chemical equilibrium of multicomponent systems under non-hydrostatic stress conditions, method of Montier cycles will be used, theoretical studies to determine the nature of simultaneous processes with respect to parallel and consecutive couplings which can be detected macroscopically, diffusional creep processes.

SOUTHERN CALIFORNIA, UNIVERSITY OF

275. GRAIN BOUNDARY SLIDING DURING HIGH-TEMPERATURE CREEP \$ 36,000 01-01
T. G. Langdon - Dept. of Materials Science & Mechanical Engineering

Deformation mechanisms occurring at low stress levels, dependence of grain boundary sliding on stress, temperature, grain size, and crystalline structure using HCP and FCC metals, evolution of grain boundary strengthening processes.

STANFORD UNIVERSITY

276. STRUCTURE DEPENDENCE OF HIGH TEMPERATURE DEFORMATION OF METALS \$ 54,000 01-01
C. R. Barrett and W. D. Nix - Dept. of Materials Science & Engineering

High temperature failure mechanisms, experimental and theoretical work on the effects of He bubbles on high temperature creep and creep rupture properties, effects of precipitate free zones in precipitation strengthened alloys, structure and mechanical properties of fine grained refractory metals prepared by high rate physical vapor deposition.

STANFORD UNIVERSITY (Continued)

277. NITRIDE FORMING REACTIONS IN LIQUID URANIUM ALLOYS \$ 48,348 01-01
N. A. Parlee - Dept. of Applied Earth Sciences

Kinetic mechanisms of UN and U_2N_3 formation and decomposition in liquid U-Sn alloys, study of nitrogen-nitride equilibria in liquid lanthanide-tin alloys, interaction effects on nitride precipitation of selected nitride formers as third elements with U-Sn alloys.

TENNESSEE, UNIVERSITY OF

278. APPLICATION OF ADIABATIC CALORIMETRY TO METAL SYSTEMS \$ 26,246 01-01
E. E. Stansbury and C. R. Brooks - Dept. of Chemical and Metallurgical Engineering

Heat capacity of liquid metals (Ga, Bi) up to 1000°C, calorimetric study of heat capacity of deformed 304 and 316 austenitic stainless steels, calorimetric equipment development, heat capacity of Pt from 30 to 1000°C.

279. MICROSTRUCTURE-PROPERTY RELATIONSHIPS IN AUSTENITIC STAINLESS STEELS \$ 26,000 01-01
J. E. Spruiell - Dept. of Chemical and Metallurgical Engineering

Time-temperature-precipitation studies of pretreated Ti modified type 316 and type 321 stainless steel, thermal stability of type 316 stainless steel weldments and the effect of thermal and mechanical post-weld treatments, electron irradiation studies of dislocation loop and void nucleation.

TEXAS, UNIVERSITY OF

280. ELEVATED TEMPERATURE MORPHOLOGICAL STABILITY OF METAL MATRIX FIBER COMPOSITES \$ 21,016 01-01
T. H. Courtney - Dept. of Mechanical Engineering

Mechanisms and kinetics associated with morphological instabilities in metal matrix fiber composites, Al-Al₃Ni system, Cu-Cr and Pb-Sn, rate of coarsening, kinetics of microstructural breakdown as a function of temperature, surface characteristics of fiber-matrix interface and presence or absence of as-grown microstructural defects.

UTAH, UNIVERSITY OF

281. IMPURITY EFFECTS ON THE CREEP OF POLYCRYSTALLINE MAGNESIUM AND ALUMINUM OXIDES AT ELEVATED TEMPERATURES \$ 25,152 01-01
R. S. Gordon - Division of Materials Science and Engineering

Steady state and transient creep studies under four-point bending conditions between 1100 and 1600°C, MgO and Al₂O₃ doped with selected transition metal impurities (Fe, Cr), to understand the effect of impurities in governing the relative roles of the diffusional, unaccommodated grain boundary sliding and dislocation mechanisms to high temperature creep.

282. POSITRON LIFETIME MEASUREMENTS AS A NON-DESTRUCTIVE TECHNIQUE TO MONITOR FATIGUE DAMAGE \$ 30,652 01-01
J. G. Byrne; acting P. I.,
R. W. Ure, Jr. - Division of Materials Science & Engineering

Measurements of positron lifetime in Cu single and polycrystalline materials, delayed slow-fast coincidence measurements, effect of point defects injected by high energy electron irradiation and tensile and fatigue modes of plastic deformation, transmission electron microscopy, effect of hydrogen.

VERMONT, UNIVERSITY OF

283. THERMODYNAMIC AND TRANSPORT PROPERTIES OF INTERSTITIAL HYDROGEN ISOTOPES IN PALLADIUM
J. S. Brown - Dept. of Physics \$ 18,361 02-02

Partial wave phase shifts for the conduction-core interaction in both solid and liquid Pd, interstitial alloy properties of Pd-H and Pd-D, development of a CPA theoretical description of electron propagation in a random interstitial ternary alloy; phonon dispersion, resistivity and thermopower of Pd.

VIRGINIA, UNIVERSITY OF

284. ELECTRONIC PROPERTIES OF METALS AND ALLOYS
R. V. Coleman - Dept. of Physics \$ 76,000 02-02

Transport phenomena, electron tunneling, optical reflectivity, ferromagnetic metals and alloys, layer structure superconductors, transition metal oxides, Fe, Co, NbSe₂, TaSe₂, NbTe₂, Fe₃O₄, Ti₂O₃, magnetoresistance and Hall effect used to study Fermi surfaces, inelastic electron tunneling measurements used to study amino acids and radiation induced changes in molecules, electron tunneling to study superconducting energy gaps, spin polarization and phase behavior in oxides.

285. INVESTIGATIONS ON THE BEHAVIOR OF POINT DEFECTS AND DISLOCATIONS
D. Kuhlmann-Wilsdorf - Depts. of Materials Science and Physics \$ 98,911 (18 mos.) 02-02

Relationships between two-body interatomic potentials and elastic constants, collapse of voids in stressed metals due to surface diffusion of atoms on the void surface, defect calculations employing near-neighbor non-central atom-atom interactions, surface stress and the melting of small particles, radiation damage in bi-crystal films, energy dispersive x-ray spectrometry, stress distributions about dislocation arrays, computer simulation of surfaces.

WASHINGTON, UNIVERSITY OF

286. MOSSBAUER STUDIES AT HIGH PRESSURE \$ 35,000 02-02
R. L. Ingalls - Dept. of Physics

Measurement of the Mössbauer effect in solids under pressure up to 300 Kbar, internal magnetic field, isomer shift, phase changes, Invar, stainless steel, FeF₂.

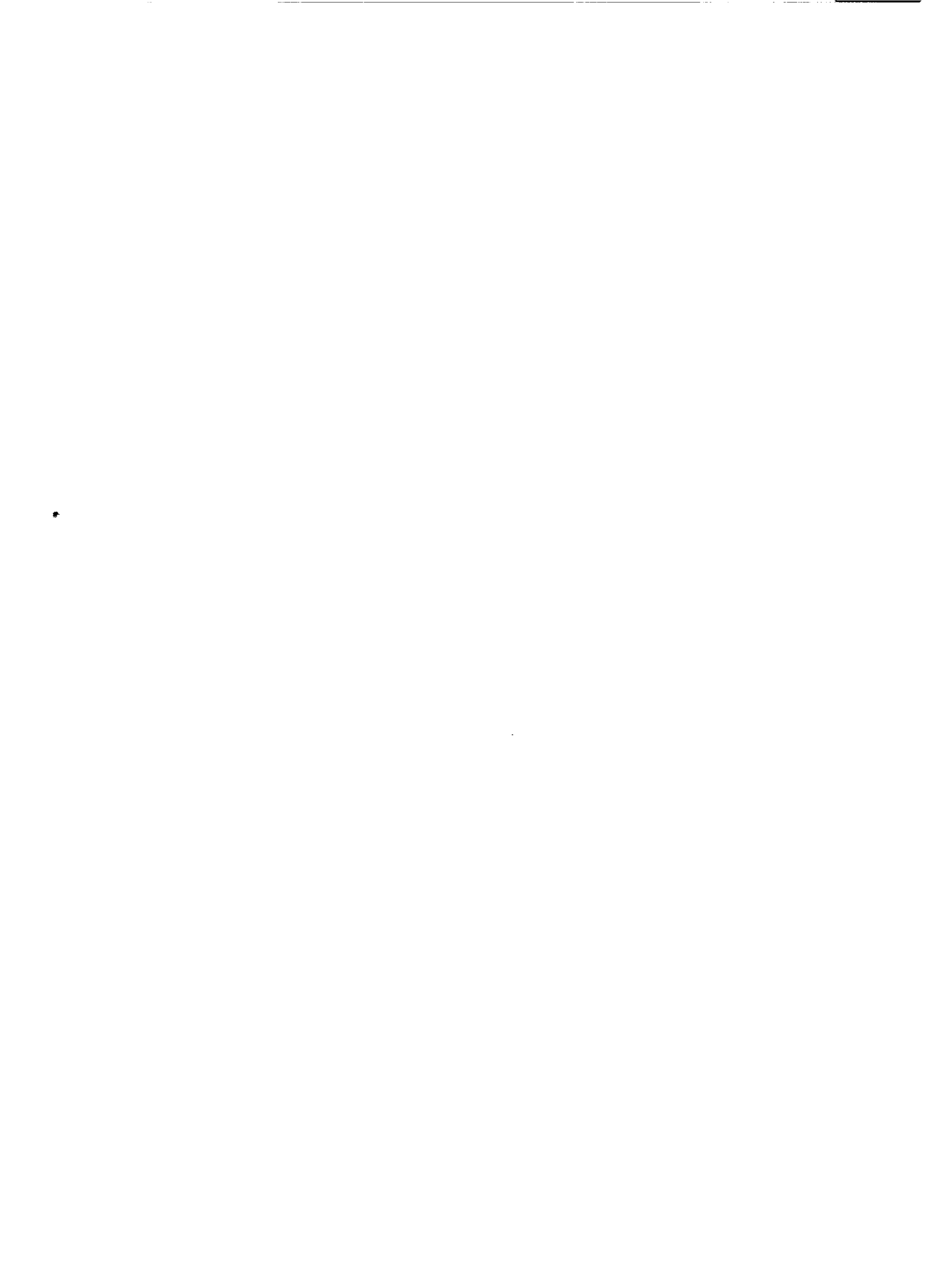
287. A STUDY OF PHASE TRANSFORMATIONS \$ 36,441 01-01
AND SUPERCONDUCTIVITY
D. H. Polonis - Dept. of Mining,
Metallurgical and Chemical Eng.

Study of pre-precipitation processes in beta stabilized alloys based on Ti and Zr, effects of plastic deformation on the subsequent pre-precipitation reactions, factors that affect the temperature coefficient of electrical resistivity, correlations between microstructure and magnetization behavior, critical current measurements.

WISCONSIN, UNIVERSITY OF

288. VOID NUCLEATION AND GROWTH IN \$ 63,000 01-03
HEAVY ION AND ELECTRON BOMBARDED
PURE METALS
G. L. Kulcinski - Dept. of
Nuclear Engineering

Nucleation and growth of voids in pure Al and V, use of high energy Al or V ions, electron irradiations, selected doping with He or H, HVEM, 2 MeV accelerator.





SUMMARY OF
FUNDING LEVELS

During the fiscal year ending June 30, 1973, the Metallurgy and Materials Programs total support level amounted to about \$24.2 million in operating funds and \$1.5 million in equipment funds. These separately identified equipment funds are expended primarily at AEC 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 \$24.2 million operating funds.

1. By Region of the Country:

	<u>Contract Research (%)</u>	<u>Total Program (%)</u>
(a) Northeast	44.0	20.7
(Mass., R.I., Penn., N.Y., N.H., D.C., Md., Vt., Conn.)		
(b) South	8.8	22.6
(Fla., Ga., N.C., Tenn., Ala., Va.)		
(c) Midwest	20.6	41.8
(Ohio, Ill., Wisc., Mich., Minn., Ind., Iowa)		
(d) West	26.6	14.9
(Ariz., Utah, Calif., Colo., Mont., Okla., Ore., Texas, Wash., Hawaii)		

2. By Academic Department or Laboratory Division:

	<u>Contract Research (%)</u>	<u>Total Program (%)</u>
(a) Metallurgy, Materials Science, Ceramics, Other Engineering (Office Budget Activity Numbers 01-)	58.8	46.7
(b) Physics, Solid State Science, Solid State Physics (Office Budget Activity Numbers 02-)	41.2	53.3

SUMMARY OF
FUNDING LEVELS

3. By AEC Laboratory and University:

	<u>Total Program (%)</u>
(a) University Program (including those laboratories where graduate students are involved in research to a large extent).....	42.3
(b) Laboratory Program	57.7

4. By Laboratory:

	<u>Total Program (%)</u>
Ames Laboratory	10.2
Argonne National Laboratory	22.3
Brookhaven National Laboratory.....	11.9
Illinois, University of (Materials Research Laboratory)	4.9
Lawrence Berkeley Laboratory	7.2
Mound Laboratory	0.4
Oak Ridge National Laboratory	20.8
Pacific Northwest Laboratory	2.4
Contract Research	19.9

SUMMARY OF
FUNDING LEVELS

- 65 -

5. By Selected Areas of Research:

	Number of Projects (Total=190) <u>(%)</u>	Total Program \$ <u>(%)</u>
(a) Materials		
Actinide Metals and Compounds	11.0	6.3
BCC Refractory Metals	22.7	11.4
Ceramics	14.2	8.6
Rare Earth Metals and Compounds	8.9	6.8
(b) Technique		
Neutron Scattering	6.8	16.4
Theory	10.5	9.1
(c) Phenomena		
Diffusion	9.5	5.0
Strength	21.6	10.3
Superconductivity	13.1	9.3
Surface Phenomena and Thin Films	13.7	8.2
Void Formation	5.8	4.9
(d) Environment		
High Pressure	6.8	3.7
Hydrogen	6.8	2.2
Radiation	19.5	17.8



SECTION D

Index of Investigators,
Materials, Phenomena,
Technique and Environment

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

INVESTIGATORS

Abraham, M. M., 92
Aldred, A. T., 21
Allen, R. P., 100
Altstetter, C. J., 47
Anderson, M. S., 12
Anne, J., 34,35
Appleton, B. R., 95
Arai, T., 32
Ardell, A. J., 206
Arko, A. J., 17
Arsenault, R. J., 245
Artman, J. O., 211
Avitzur, B., 243
Axe, J. D., 37

Bailey, D. M., 4
Balluffi, R. W., 223
Bari, R. A., 42
Barnes, R. G., 10
Barrett, C. R., 276
Barrett, J. H., 97
Beck, P. A., 48
Berard, M. F., 3
Bevolo, A. J., 13
Bilello, J. C., 260
Birnbaum, H. K., 49
Blewitt, T. H., 23
Bloom, E. E., 88
Blume, M., 42
Blumenthal, R. N., 244
Borie, B. S., 85
Bourassa, R. R., 267
Bowers, R., 230
Bradley, W. L., 219
Bradt, R. C., 269
Bragg, R. H., 71
Brewer, L., 70
Brimhall, J. L., 102
Brodsky, M. B., 17
Brooks, C. R., 278
Broutman, L. J., 240
Brown, J. S., 283

Brun, T., 26
Brundage, W. E., 89
Bruni, F. J., 89
Brynstad, J., 82
Burnet, G., 8
Butler, W. H., 84
Byrne, J. G., 282

Cable, J. W., 93
Carlson, O. N., 2,5
Carlson, P. T., 83
Carpenter, R. W., 79
Cathcart, J. V., 86
Chen, C. W., 7
Chen, S. H., 249
Chen, W. K., 18
Chen, Y., 94
Chesser, N. J., 15
Chikalla, T. D., 101
Child, H. R., 93
Chow, J., 36
Clark, G. W., 89
Clarke, J., 77
Cleland, J. W., 89
Clem, J. R., 11
Coble, R. L., 250
Coghlan, W. A., 84
Cohen, M. L., 73
Coleman, R. V., 284
Coltman, R. R., 99
Connolly, T. F., 89
Cooke, J. F., 97
Corbett, J. W., 261
Courtney, T. H., 280
Cox, D. E., 39,40
Craig, R. S., 271
Crawford, J. H., Jr., 264
Crow, J., 34,43
Culbert, H., 28

INVESTIGATORS

Dahlgren, S. D., 100
Dahm, A. J., 212
Danielson, G. C., 13
Das, E. S. P., 19
Davis, H. L., 97
De Fontaine, D., 207
Delbecq, C., 27
Dienes, G. J., 46
Drickamer, H. G., 55
Dunlap, B., 31
Duwez, P., 204

Easton, D. S., 80
Elleman, T. S., 263
Endoh, Y., 38,39

Farrell, K., 88
Faulkner, J. S., 84
Felcher, G., 26
Finch, C. B., 89
Finnemore, D. K., 11
Finnigan, J. W., 102
Fisher, E. S., 18
Fradin, F. Y., 21
Frazer, B. C., 40,41
Freyhardt, H. C., 19
Fuchs, R., 14
Fulrath, R. M., 69

Galligan, J. M., 221
Geisler, F., 44,45
Gerberich, W. W., 258
Gibala, R., 213
Gilbert, T., 32
Godfrey, T. G., 81
Goland, A. N., 44,45,46
Goldman, A. M., 256
Golovchenko, I., 44,45
Gordon, R. S., 281

Grace, R. E., 272
Granato, A. V., 56
Gray, K., 29
Gregory, W. D., 236
Gschneidner, K. A., Jr., 4
Gurland, J., 203
Guttman, L., 30

Haas, W. J., 16
Hartley, C. S., 234
Hartman, W. F., 242
Harvey, A. R., 17
Hendricks, R. W., 85
Hendrickson, A. A., 253
Herman, H., 262
Hinks, D., 25
Hodges, L., 9
Hoffman, A. R., 251
Hoffman, R. W., 214
Hoke, J. H., 269
Holmes, D. K., 97
Hren, J. J., 234
Hudgens, C. R. 78
Huebener, R., 29
Hultgren, R. R., 70
Hunter, O., 3
Hutchinson, T. E., 257

Ingalls, R. L., 286

Jackson, J., 33
Jenkins, L. H., 98
Johnson, H. H., 224

INVESTIGATORS

- A3 -

Kammerer, O., 34
 Kaplan, T., 97
 Katz, J. L., 218
 Kayser, F. X., 4
 Keating, D. T., 44,45,46
 Kesternick, W., 24
 Ketterson, J., 28,31
 Kevey, A., 41
 Kierstead, H., 30
 Kingery, W. D., 250
 Kissinger, H. E., 102
 Kjems, J., 37
 Klabunde, C. C., 99
 Klank, A. C., 23
 Kliever, K. L., 14
 Kline, G. R., 15
 Knapp, G. S., 21
 Koch, C. C., 80
 Kocks, U. F., 19
 Koehler, J. S., 61
 Koehler, W. C., 93
 Kollie, T. G., 81
 Koss, D. A., 253
 Kramer, E. J., 225
 Kroeger, D. M., 80
 Krumhansl, J. A., 226
 Kuchnir, M., 28
 Kuhlmann-Wilsdorf, D., 285
 Kulcinski, G. L., 288

 Lam, D. J., 21
 Lam, N., 18
 Lander, G. H., 22
 Langdon, F., 41
 Langdon, T. G., 275
 Larson, B. C., 96
 Lawrence, W. E., 231
 Lawson, A. W., 208
 Lazarus, D., 57
 LeFevre, B. G., 237

 Legvold, S., 9
 Leitnaker, J. M., 88
 Levy, P. W., 45
 Li, C. Y., 227
 Li, J. C. M., 274
 Liu, S. H., 9
 Loomis, B. A., 23
 Luhman, T., 34,35
 Lundy, T. S., 83
 Luo, H. L., 209
 Lynch, D. W., 14

 Marcinkowski, M. J., 247
 Marshall, S., 27
 McElroy, D. L., 81
 McMasters, O. D., 4
 McMillan, J., 27
 Merkle, K. L., 24
 Merrill, J. R., 232
 Merz, M. D., 100
 Meshii, M., 266
 Metzger, M., 50
 Mikkola, D. E., 254
 Miller, J. W., 20
 Mitchell, T. E., 215
 Mockler, R., 220
 Modine, F., 94
 Mook, H. A., 91
 Moon, R. M., 93
 Moore, J. P., 81
 Morral, J. E., 222
 Morris, J. W., Jr., 62
 Mostoller, M. E., 97
 Moteff, J., 217
 Mueller, F. M., 21,22,32
 Mundy, J. N., 18

INVESTIGATORS

- A4 -

Narayan, J., 96
 Nelson, R. D., 100
 Neumann, P. D., 19
 Nicklow, R. M., 91
 Nielsen, M., 91
 Nix, W. D., 276
 Noggle, T. S., 96
 Nolfi, F. V., Jr., 20
 Nosanow, L. H., 256
 Novaco, A. D., 42

 Oen, O. S., 97
 Ogle, J. C., 87
 Ohr, S. M., 96
 Olson, C. G., 14
 Olson, D. L., 219
 O'Reilly, D. E., 30
 Ostenson, J. E., 11
 O'Sullivan, W., 220

 Painter, G. S., 84
 Pare, V. K., 99
 Parker, E. R., 64
 Parkin, D. M., 36
 Parlee, N. A., 277
 Pask, J. A., 66
 Passell, L., 38,39,41
 Pawel, R. E., 86
 Pea-, D., 261
 Peterson, D. T., 1,2,5
 Peterson, N. L., 18
 Pickus, M. R., 63,72
 Pigg, J. C., 94
 Pipes, P. B., 233
 Pohl, R. O., 228
 Pollack, G. L., 252
 Polonis, D. H., 287
 Pong, W., 238
 Pope, D. P., 270
 Price, D. L., 26
 Primak, W., 33
 Pronko, P. P., 24
 Pugh, E. N., 51

 Rahman, A., 32
 Redman, J. K., 99
 Reed, R. E., 89
 Reed-Hill, R. E., 235
 Rice, J., 203
 Richards, P. L., 74
 Roach, P., 28
 Robinson, C. C., 89
 Robinson, J., 32
 Robinson, M. T., 97
 Rochlin, G. I., 76
 Rothman, S. J., 18
 Rowe, J. M., 26
 Rowland, T. J., 52
 Ruoff, A. L., 229

 Scattergood, R. O., 19
 Schmidt, F. A., 2,5
 Schoemaker, D., 27
 Schow, O. E., 94,95
 Schweitzer, D. G., 34,36
 Schwenterly, S. W., 90
 Scott, T. E., 1
 Searcy, A. W., 67
 Seidman, D. N., 223
 Sekula, S. T., 90
 Shanks, H. R., 13
 Shapiro, S., 37
 Shen, Y. R., 75
 Sherrill, F. A., 96
 Shirane, G., 37,38,39,41
 Shull, C. G., 248
 Sidles, P. H., 13
 Sievers, A. J., 228
 Silsbee, R. H., 230
 Simonen, E., 102
 Simmons, R. O., 58
 Sinha, S. K., 15
 Skalyo, J., 37,38
 Slichter, C. P., 59
 Smith, C. S., 265
 Smith, D., 32
 Smith, G. P., 82
 Smith, H. G., 91
 Smith, J. F., 4

Solin, S. A., 216
Sonder, E., 94
Southern, A. L., 99
Spain, I. L., 246
Sparks, C. J., 85
Spedding, F. H., 8,16
Spruiell, J. E., 279
Stanford, J. L., 9
Stanley, J. T., 201
Stansbury, E. E., 278
Starke, E. A., Jr., 237
Stassis, C., 15
Stein, D. F., 255
Stiegler, J. O., 88
Stoloff, N. S., 273
Strongin, M., 34,43
Suenaga, M., 34,35
Susman, S., 25,27
Sweedler, A., 34
Swenson, C. A., 12

Templeton, L. C., 94
Thomas, G., 65
Thorpe, A. N., 239
Tomizuka, C. T., 202
Torgeson, D. R., 10
Traylor, J. G., 15
Trivedi, R. K., 6
Tse, C., 18
Tsuei, C. C., 204
Turcotte, R. P., 101

Unruh, W. P., 92
Ure, R. W., Jr., 282

Vandermeer, R. A., 87
Varma, M. N., 43
Vashishta, P., 33
Veal, B. W., Jr., 21
Verhoeven, J. D., 5
Vreeland, T., Jr., 205

Wakabayashi, N., 91
Wallace, W. E., 271
Washburn, J., 68
Watson, R. E., 42
Wayman, C. M., 53
Wechsler, M. S., 7
Weinstock, H., 241
Welch, D. O., 46
Welty, J. R., 268
Wert, C. A., 54
Westbrook, R. D., 89
Westlake, D. G., 18
Weyhmann, W. V., 256
Wheatley, J. C., 210
Wiedersich, H., 20
Wilder, D. R., 3
Williams, D. E., 4
Williams, J. M., 96
Williams, R. K., 81
Williams, R. O., 79
Williams, W. S., 60
Wilson, J. C., 89
Wimber, R. T., 259
Windmiller, L., 31
Wittenberg, L. J., 78
Wood, R. F., 97
Worlton, T., 26

Yakel, H. L., 85
Yelon, W. B., 37,39
Yip, S., 249
Yoo, M. H., 84
Young, F. W., Jr., 98
Yust, C. S., 82
Yuster, P., 27

Zackay, V. F., 64
Zehner, D. M., 98
Zimmerman, W., Jr., 256

Actinide Metals and Compounds

1	85
2	86
5	87
7	92
17	100
18	101
22	211
31	250
78	263
82	277
83	

Ceramics

<u>Carbides</u>	<u>Glass</u>	<u>Nitrides</u>	<u>Oxides</u>			
60	66	22	3	81	94	250
85	240	91	18	82	101	255
222		277	27	83	214	269
			66	89	239	281
			69	92	244	284

Composites

50
63
66
71
243
280

Graphite and Carbon

71
81
84
96
215
241
246

Intermetallic Compounds

4	36
9	37
10	43
15	91
17	93
21	209
22	237
26	247
30	254
31	271

Ionic Crystals

Alkali Halides

25	89
26	94
27	228
45	229
46	230
57	264
83	265

Other

13	40
14	56
16	69
25	92
33	208
37	211
39	240

Liquids

5
26
30
75
78
219
220
249
268
277

Metals

<u>Alkali</u>	<u>BCC Refractory</u>		<u>Ferrous</u>	
12	1	83	5	215
57	2	86	48	219
219	5	87	49	224
229	6	88	62	247
	7	89	64	255
	11	90	65	258
	13	99	72	263
	14	102	88	278
	15	213	97	279
	18	217	201	284
	19	222	203	286
	23	223		
	29	225		
	47	235		
	49	245		
	52	253		
	53	260		
	54	266		
	57	273		
	79	276		
	80	288		
	81			

Organics

60
65

Rare Earth Metals and Compounds

2 25
3 28
4 31
8 89
9 93
15 97
16 208
17 271
22

Semiconductors

15	76
61	77
68	89
73	216
74	

Solid and Liquid Inert Gases

15	202
28	210
30	252
38	256
58	

Acoustic Emission

51
242
258

Computer Simulation

19
97
207
223
234
245

Elastic Constants

4
18
56
229
265

Electron Microscopy

5	205
7	206
24	213
50	215
53	217
54	222
65	234
68	247
69	254
82	257
88	260
96	266
102	272

Electron Spin Resonance

27
30
92
94
208
230
264

Field Ion Microscopy

52
68
223

High Temperature Heat Capacity

81
278

Infrared Spectroscopy

14
74
228
264

Internal Friction

7
44
49
99
213

Laser Beam Scattering

58	76
74	216
75	220

Low Temperature Specific Heat

4
12
17
21
28
48
80
271

Magnetic Susceptibility

4	28
16	48
17	236
18	239

Mossbauer Effect

10	55
21	211
31	286

Neutron Scattering

15	40
22	41
26	91
32	93
37	248
38	249
39	

Nuclear Magnetic Resonance

10	52
21	59
30	214

Optical Absorption

14	75
16	94
21	211
45	238
55	264

Positron Annihilation

21
44
282

Sputtering

13
53
100
209
257

Theory

9	62
11	73
14	84
18	97
19	218
20	226
31	256
32	261
42	274
46	283

Thermal Conductivity

3	230
13	241
78	268
81	

Channeling

20
24
45
95

Crystal Structure, Atomic Distribution and Crystal Transformations

4	70
22	85
30	100
37	101
53	204
62	207
65	215

Diffusion

3	57
5	66
6	69
10	83
18	202
20	224
24	250
49	263
52	272

Dislocations

19
49
60
62
205
207
234
270
285

Electron Transport

7	236
13	241
17	246
231	267
232	284
233	

Electronic Structure

Fermi SurfaceOther

9	22	59
31	31	73
251	32	81
284	42	84
	55	97

Magnetism

4	42
9	48
10	91
16	93
17	208
21	248
22	256
32	271
39	286
40	

Materials Preparation and Characterization

2
8
25
89
208
250

Phonons

37	216
75	226
81	228
91	230
97	252

Point Defects

18	96
20	99
23	207
24	217
27	223
33	234
49	239
58	264
61	266
68	285
94	

Precipitation

20	201
35	206
47	222
52	261
54	276
65	279
66	287
79	

Recovery and Recrystallization

87	
254	

Sintering

66
69
72
250

Solidification

5
71

Strength

<u>Fracture</u>		<u>Fatigue</u>	<u>Creep</u>	<u>Flow Stress</u>		
2	240	19	1	1	64	237
7	247	203	19	2	82	242
64	258	219	203	7	88	243
79	269	262	250	19	100	245
203	273	273	274	47	206	247
224	276	282	275	50	213	253
			276	54	221	260
			281	56	227	266
				62	235	

Stress-Corrosion Cracking

51
224
255
258

Superconductivity

4	35	80	225
11	36	90	231
19	43	100	233
21	63	204	236
29	73	209	251
32	76	221	287
34	77		

Surface Phenomena and Thin Films

6	68	227
14	86	238
24	98	252
34	214	255
43	219	257
53	220	275
66	223	280

Void Formation

7	206
20	217
23	218
83	285
88	288
102	

Electric Field

2
5

Gas

<u>Oxidizing</u>	<u>Hydrogen</u>	
86	1	213
259	10	224
	18	263
	26	271
	32	282
	49	283
	52	

Magnetic Field

4	26	59	228
9	27	71	230
10	29	80	236
11	31	81	246
13	34	93	248
16	35	204	255
17	48	208	271
21	52	211	284
22	55	214	286

Pressure

Above Atmospheric

12	202
18	228
26	229
31	246
55	265
57	286
83	

Radiation	<u>Ion</u>		<u>Neutron</u>		<u>Theory</u>	<u>Gamma</u>
<u>Electron</u>						
33	18	95	7	102	46	27
44	20	100	23	201	97	45
61	23	102	33	217	218	
88	24	206	85	225		
96	33	223	88	241		
215	36	239	90	245		
266	68	263	99			
279	88	288				
288						

Temperature

Below Liquid Helium (4.2°K)

11
 12
 28
 43
 77
 210
 228
 236
 241
 252
 256

