METALLURGY
and
MATERIALS
PROGRAMS

●

FY 1968

UNITED STATES ATOMIC ENERGY COMMISSION
DIVISION of RESEARCH

METALLURGY

AND

MATERIALS

PROGRAMS

Fiscal Year 1968

September 1968

U. S. Atomic Energy Commission

Division of Research

FOREWARD

The Metallurgy and Materials Program constitutes one portion of a wide range of research supported by the AEC Division of Research. Other programs are administered by the Division's Controlled Thermonuclear Research, 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 wider spectrum of scientific and engineering areas and is conducted generally by personnel trained in the disciplines of Solid State Physics, Metallurgy, Ceramics, and Physical Chemistry.

This report attempts to summarize and index the various research projects which were underway in FY 1968. Since the format is somewhat experimental, it is hoped that your comments on this first report will help us to improve future editions.

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

INTRODUCTION

The purpose of this report is to provide a convenient compilation and index of the AEC's Metallurgy and Materials Programs. Hopefully, this compilation will be used by administrators, managers, and scientists to coordinate research and aid in selecting new programs.

The report is divided into a section listing all the projects, an index, and then a summary of funding levels.

Each project carries a number (underlined) for reference purposes. The FY 1968 funding level, title, personnel, budget activity number (e.g. 01-02), and key words and phrases accompany the project number. The indices refer to the project numbers and are grouped by (1) investigators, (2) materials, (3) technique, (4) phenomena, and (5) environment.

The last section summarizes the total funding level in a number of selected categories. Obviously most projects could be classified under more than one category. It must be recognized that it is impossible to include all the technical data available for such a large program. By the time it could be compiled it would be outdated. Rather, 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 the investigators.

Any suggestions for improving this report will be greatly appreciated.

Louis C. Ianniello
Metallurgy and Materials Programs
Division of Research

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SECTION A

Laboratory Research Program

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 1968.

AEC Laboratories

AMES LABORATORY
U. S. Atomic Energy Commission
P. O. Box 1129, Station A
Ames, Iowa 50012
Phone: Area Code 515 284-4000

Metallurgy Division -01-
J. F. Smith - Phone: 294-1821

1. "Dislocation Behavior" $65,000 01-01
M. J. Marcinkowski
strength, deformation mechanisms in superlattice alloys, theory of dislocation interactions, twinning, cross-slip

2. "Crystal Plasticity" $170,000 01-01
D. T. Peterson, T. E. Scott
deformation in Cu-2% Co, Th-N alloys, electronic structure-mechanical behavior, superplasticity in Al-Zn

3. "Structure and Properties of Solids" $275,000 01-02
P. Chiotti, K. A. Gschneidner, F. X. Kayser,
J. F. Smith, D. M. Bailey
atomic structure, heat capacity, elastic constants, magnetic properties, compounds, lanthanides, Th U Fe alloys

4. "Diffusion and Transport Properties" $100,000 01-02
O. N. Carlson, D. T. Peterson,
J. D. Verhoeven
electrotransport & chemical diffusion in liquid metals, solidification, electromigration of impurities in solid Zr Cr Lu, diffusion

5. "Properties of Surfaces" $65,000 01-02
R. K. Trivedi
surface energy-crystal orientation of V., surface diffusion anisotropy

6. "Radiation Damage" $95,000 01-03
C. W. Chen
neutron irradiation, liquid N_2 temperature, mechanical properties, internal friction, resistivity, V, precipitation in Al alloys

Physics Division -02-
C. A. Swenson - Phone: 294-5288

7. "Materials Preparation & Characterization" $135,000 02-01
F. H. Spedding
high purity rare earths, single crystals, physical properties

AMES LABORATORY
Physics Division -02- (continued)

8. "Electronic Properties of Metals" $239,000 02-02
A. V. Gold, L. Hodges, T. L. Loucks,
J. L. Stanford, R. Fivaz, D. R. Stone,
R. A. Phillips, T. Wagner

APW calculations, Fermi surface, impulsive field de Haas van Alphen data, rare earths, transition metals

9. "Electronic Structure of Crystalline Solids" $165,000 02-02
R. G. Barnes, R. A. Reese, D. R. Torgeson

NMR, ESR, Mössbauer effect, magnetic structure, electric field parameters, non cubic metals, rare earth intermetallics

10. "Superconductivity" $180,000 02-02
J. R. Clem, D. K. Finnemore,
S. H. Liu, R. L. Cappelletti

gapless, coexistence with antiferromagnetism, dynamics of type II, Kondo effect, specific heat, magnetization, neutron scattering

11. "Thermodynamic Properties of Solids" $120,000 02-02
C. A. Swenson

lattice properties at low temperature and high pressure, equation of state, thermal expansion, inert gas solids, alkali metals

12. "Transport Properties of Solids" $254,000 02-02
G. C. Danielson, J. J. Martin,
P. H. Sidles, K. Tanaka

thermal diffusivity, standard for thermal conductivity, Li drifted Ge detectors, Mg compounds, W bronzes, electron transport

13. "Magnetic Materials: Rare Earth Metals and Rare Earth Compounds" $120,000 02-02
R. H. Good, J. M. Keller, S. H. Liu,
S. Legvold, F. H. Spedding, J. L. Stanford
R. W. G. Syme

cooperative phenomena, high radio frequency properties, absorption of very short wavelength, magnetoresistance, high field studies

14. "Optical Properties of Solids" $180,000 02-02
R. Fuchs, K. L. Kliewer, D. W. Lynch

optical constants using 250 MeV electron storage ring, theory of anomalous skin effect-interband transitions-diffuse electron scattering, Ag alloys, halides

AMES LABORATORY
Physics Division -02- (continued)

15. "Neutron Scattering in Solids" $75,000 02-02
S. K. Sinha, F. H. Spedding, T. O. Brun,
R. P. Gupta, L. Muhlestein, J. Sakurai
phonon dispersion curves in solid He, magnetic moments in compounds - $DyCo_2$

16. "Optical and Magnetic Properties of Rare Earth Salts Solutions, Metals & Alloys" $225,000 02-02
F. H. Spedding, R. H. Good
absorption spectra of ethylsulfates, Raman spectra, Stark levels, Zeeman effect, magnetic susceptibility

ARGONNE NATIONAL LABORATORY
9700 South Cass Avenue
Argonne, Illinois 60440
Phone: Area Code 312 739-7711

Metallurgy Division -01- 22
M. Nevitt - Phone: 739-2257
N. Peterson - Phone: 739-3549

17. "Theory" $63,000 01-01
L. C. Roland Alfred, F. M. Mueller*,
I. R. Goroff
*also Solid State Science Division
band structure of actinides, screening field around atomic imperfections, resistivity changes due to defects

18. "Kinetics Studies" $182,000 01-01
J. E. Draley, R. K. Hart,
R. A. Legault, R. H. Spitzer
oxidation of Zr crystals, electron microscopy and diffraction of film nucleation, X-ray emission spectra

19. "Physical Metallurgy" $300,000 01-01
M. B. Brodsky, L. M. Atlas,
R. G. Liptai, J. J. Rechtien,
W. J. Nellis
single crystals of Pu, high pressure studies, deformation, transformations, Hall Effect, magnetoresistivity, U Np Pu Am, defect equilibria in PuO_2 PuC

20. "Mechanical Metallurgy" $172,000 01-01
U. F. Kocks, C. Y. Cheng,
R. O. Scattergood, P. O. Kettunen
ductility of polycrystalline HCP metals, work hardening, dislocation damping, fatigue

21. "Metal Physics" $412,000 01-01
N. L. Peterson, W. K. Chen, E. S. Fisher,
S. J. Rothman, M. L. Volpe, D. G. Westlake,
J. N. Mundy, C. M. Walter
Zn Fe diffusion, defects and diffusion in CoO NiO, H embrittlement of V Nb, elastic modulus Ti R.E. alloys

22. "Alloy Properties" $519,000 01-02
J. B. Darby, Jr., A. T. Aldred, D. I. Bardos,
A. E. Dwight, F. Y. Fradin, L. L. Isaacs,
D. J. Lam, K. M. Myles, C. W. Kimball,
H. Montgomery, J. W. Ross
magnetization measurements Fe R.E. actinides, low temperature specific heat Tc alloys, transport properties transition metals, NMR, Mössbauer effect, thermodynamics

ARGONNE NATIONAL LABORATORY
Metallurgy Division -01- (continued)

23. "Scattering Studies" $492,000 01-02
M. H. Mueller, L. Heaton, M. Kuznietz,
G. H. Lander, D. A. Matthews, J. M. Williams
neutron magnetic scattering in binary U Pu Np compounds, magnetic moment Fe alloys, liquids, intermetallic compounds

24. "Resonance Studies" $119,000 01-02
D. O. VanOstenburg, G. A. Matzkanin, positron annihilation
J. J. Spokas, H. G. Hoeve
wide line and pulsed NMR, electronic interactions in metal solutions, magnetic transitions in U Th compounds, theory

25. "Basic Irradiation Studies" $561,000 01-03
T. H. Blewitt, C. A. Arenberg,
R. M. J. Cotterill, E. E. Gruber,
A. C. Klank, B. A. Loomis, K. L. Merkle,
N. P. Sigmund, G. Kostorz, J. A. Tesk
yield behavior of neutron irradiated Nb Fe Mo Cu Al, lattice parameter, resistivity, defects, ion irradiation, pores in solids

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

26. "Material Purification and Crystal Growth" $54,000 02-01
S. Susman, D. Hinks

alkali halides, pure single crystals, impurity doping

27. "Neutron Scattering" $695,000 02-02
J. M. Rowe, D. L. Price, D. W. Connor,
G. P. Felcher, R. Lechner, I. Pelah,
R. Shamu, K. Sköld, F. A. Smith
inelastic neutron scattering, slow neutrons, dynamics of H in compounds, liquid Ne A Kr V, neutron diffraction at high pressure, small angle neutron scattering

28. "Defects in Nonmetallic Crystals" $80,000 02-02
P. Yuster, C. Delbecq, D. Schoemaker,
S. Susman
irradiation effects on alkali halides, ESR, color centers, infrared visible ultraviolet light absorption

ARGONNE NATIONAL LABORATORY
Solid State Sciences Division -02- (continued)

29. "Very-low-temperature Studies" $115,000 02-02
J. Ketterson, Y. Eckstein, M. Kuchnir, P. Roach
sound attenuation velocity, phase separation He-3 He-4 mixtures, specific heat, millidegree range

30. "Superconductivity and Low-Temperature Calorimetry" $100,000 02-02
H. Culbert, R. Huebener, V. Rowe
low temperature specific heat Pb-Tl Pb-In alloys rare earth oxides, thermal and electronic conducitivity, Nernst effect in superconducting Pb In Sn Nb

31. "Phase Transitions and Critical Phenomena" $229,000 02-02
L. Guttman, H. Kierstead, D. O'Reilly, D. Genin, H. Schnyders
small angle X-ray scattering Fe-Al Fe-Co, phase boundaries for He, magnetic resonance, ESR, NMR, ferroelectric transition

32. "Electronic and Magnetic Properties" $293,000 02-02
M. Kalvius, J. Ketterson, L. Windmiller, M. Kanter, B. Dunlap, G. Shenoy, S. Hörnfeldt, J. Kusmuss, J. Munarin
Mössbauer studies actinides rare earths ferrous compounds, Fermi surface Pt Pd Rh U Co, electron transport U compounds

33. "Electron Spin Resonance and Kinetic Studies" $209,000 02-02
B. Smaller, S. Marshall, J. McMillan, T. Halpern
studies of short lived paramagnetic species, ESR of hydrated electron in aqueous solutions, paramagnetic defects in calcite ThO_2

34. "Solid State Theory" $446,000 02-02
T. Arai, S. Eckstein, T. Gilbert, R. Land, F. Mueller, A. Rahman, J. Robinson, M. Tosi, K. Singwi, D. Smith, W. Hartman, C. Isenberg, W. Massey, B. Varga
correlation phenomena, electrons in narrow bands quantum liquids and solids, interatomic forces, insulations, liquids, lattice dynamics

35. "Energetic Particle Interaction" $289,000 02-03
J. Jackson, M. Doyama, W. Primak, G. Montet
metals Al Pt, insulators SiO_2, semiconductors Ge Si, graphite, $NbSe_2$ MoS_2

ATOMICS INTERNATIONAL
(Division of North American Aviation, Inc.)
Box 309
Canoga Park, California 91304
Phone: Area Code 213 341-1000

Physics Technology -02-
R. G. Breckenridge - Phone: 341-1000 x1316

36. "Electronic Structure" $201,000 02-02
H. J. Fink, L. J. Barnes, W. J. Tomasch
superconductivity, electron tunneling, Fermi surface, low temperature specific heat, magnetoresistance

37. "Radiation Damage" $286,000 02-03
W. Bauer, H. H. Neely, K. Garr,
W. F. Goeppinger, D. W. Keefer,
J. C. Robinson, K. H. Thommen,
D. D. Vawter
electron irradiation of Fe W Zr Al Cu GaSb GaAs, resistivity changes, annealing

BATTELLE MEMORIAL INSTITUTE
505 King Avenue
Columbus, Ohio 43201
Phone: Area Code 614 299-3151

38. "Investigation of Steady State Creep in Nonstoichiometric Compounds" $29,000 01-01
M. S. Seltzer
creep in PbS as a function of temperature, stress, orientation, stoichinometry

39. "Correlation of Dislocation Substructure With Creep Properties in Refractory Metals" $20,000 01-01
A. H. Clauer, B. A. Wilcox
creep in Mo, electron microscopy, up to 1650°C

BROOKHAVEN NATIONAL LABORATORY
Upton, Long Island, New York 11973
Phone: Area Code 516 924-6262

Materials Science Department -01-
D. H. Gurinsky - Phone: 924-6349
A. Paskin - Phone: 924-2707

40. "Liquid Metals" $230,000 01-02
J. Dickey, A. Paskin, P. Adams,
P. Ascarelli, S. Epstein
mass transport in liquid metals, electromigration in liquid metals, electron transport, theory

41. "Superconductivity" $255,000 01-02
A. Paskin, M. Garber, O. F. Kammerer,
M. Strongin, D. Schweitzer
irreversible properties, ultra thin films, high field limits, low temperature properties, quantum effects

Department of Physics -02-
G. J. Dienes - Phone: 924-6633

42. "Spin Waves and Critical Scattering" $276,000 02-02
R. Nathans, S. J. Pickart, F. Menzinger,
M. F. Collins, L. Passell, V. J. Minkiewicz,
G. Shirane
neutron scattering - dynamic response of magnetic materials, second order phase transitions, spin wave dispersion relations in 3d metals

43. "Lattice Dynamics and Phase Transitions" $354,000 02-02
J. A. Leake, J. Skalyo, B. C. Frazer,
G. Shirane, V. J. Minkiewicz, T. A. Kitchens,
R. Nathans, Y. Yamada, H. Umebayashi
inelastic neutron scattering, inert gas crystals, ferroelectrics, phonon spectrum, pressure dependence

44. "Neutron Electric Dipole Experiment" $55,000 02-02
R. Nathans
search for existence of neutron electric dipole

45. "Spin Density and Magnetic Structures" $203,000 02-02
H. Umebayashi, J. Skalyo, D. E. Cox,
B. C. Frazer, G. Shirane, F. Menzinger,
J. A. Leake
magnetic ordering, electronic configuration, polarized beam study of $CuSO_4$, spin density in compounds, pressure dependence of helical angle in Tb Ho

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

46. "Materials Synthesis and Crystal Growth" $92,000 02-02
F. C. Merkert, J. J. Hurst, D. E. Cox, C. J. Klamut
materials preparation for crystal physics, Ge monochromators for neutron scattering

47. "Solid State Theory" $300,000 02-02
M. Blume, J. A. Tjon, O. C. Kistner, R. M. Sternheimer, J. B. Sokoloff, H. J. Lee, R. E. Watson, G. H. Vineyard
Mössbauer line shape, shielding of crystal fields, spin waves in metals, Knight shift analysis, ferromagnetism

48. "Organic Crystals" $170,000 02-03
R. Arndt, A. Damask, W. Whitten, T. Sabine, P. Coppens
effects of radiation on simple aromatic hydrocarbon crystals, phenanthrene, anthracene, chrysene, S-triazene

49. "Ionic Crystals" $170,000 02-03
P. W. Levy, J. Alvarez Rivas, J. S. Butterworth, P. D. Esser, A. Lemos, P. Herley, P. Mattern
radiation effects in pure and doped alkali halides, use of radiation effects for geological dating, NaCl, KCl, $NaBrO_3$, natural calcite

50. "Diffraction Studies of Imperfect Crystals" $77,000 02-03
B. Mozer, D. Keating, T. Sabine
X-ray and neutron scattering to study crystal imperfections, irradiated MgO and BeO, clustering in alloys

51. "Superconductivity" $77,000 02-03
M. Strongin, O. Kammerer
thin films, effect of film thickness on superconductivity, composite films

52. "Electron Irradiation Studies With the Dynamitron" $196,000 02-03
A. Goland, H. Wegner, P. W. Levy, P. Mattern, J. A. DiCarlo, C. L. Snead, R. Dinardo
resistivity changes, internal friction, dynamic modulus, tungsten, equipment development

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

53. "Defect and Radiation Effects Theory" $160,000 02-03
R. A. Johnson, A. Goland, D. Keating,
M. Blume, W. D. Wilson, G. J. Dienes,
R. D. Hatcher, A. Blum, C. Erginsoy,
P. Kemmey, P. Mattern, A. Paskin,
B. Bronk
computer calculations of point defects, C clustering in Fe, channeling, ionic crystals, electronic structure of Azide ion

IDAHO NUCLEAR CORPORATION
P. O. Box 1845
Idaho Falls, Idaho 83401
Phone: Area Code 208 526-2491

-02-

54. "High Pressure Neutron Diffraction" $150,000 02-02
R. M. Brugger, T. G. Worlton,
R. B. Bennion, D. L. Decker
time-of-flight neutron scattering technique at pressures up to 100Kb, Bi, Fe_2O_3, Cr_2O_3, Al

ILLINOIS, UNIVERSITY OF
Urbana, Illinois 61803
R. J. Maurer - Phone: Area Code 217 333-1370

Metallurgy Department -01-
C. A. Wert - Phone: 333-1440

55. "Electronic Specific Heat of Alloys of Transition Metals With Nontransition Elements" — $55,000 — 01-02
P. A. Beck

low temperature specific heat measurements Cr-Al Re-Co, magnetic susceptibility VAu_4 $CrAu_4$

56. "Strain Energy in Martensitic Transformation" — $38,000 — 01-02
C. J. Alsetter

martensitic transformations in La Co-Ni, O and N in solid solution in BCC refractory metals, V Nb Ta

57. "Point Defect-Dislocation Interactions" — $99,000 — 01-02
H. K. Birnbaum

BCC metals, internal friction, creep, diffusion, Ni-Co, Nb, H in Nb, Ta Mo W

58. "Glass and Crystalline Oxide Semiconductors" — $14,000 — 01-02
A. L. Friedberg

V-P-O system, discontinued after FY 1968

59. "Mechanical and Surface Behavior of Crystals" — $102,000 — 01-02
J. J. Gilman

elastic constants in calcite, growth of refractory carbides WC TiC VC, field ion microscopy surface studies

60. "First Order Phase Transformations in Crystalline Solids" — $50,000 — 01-02
D. S. Lieberman

morphology kinetics crystallography internal structure of martensite, steel NbRu TaRu TiNi AuCd

61. "Dislocations and Surface Barriers - Corrosion at Lattice Defects" — $51,000 — 01-02
M. Metzger

mechanical behavior of coated and composite crystalline materials, structure sensitive etching and corrosion, Cu Al Zn oxides

ILLINOIS, UNIVERSITY OF
Metallurgy Department -01- (continued)

62. "Annealing of Cold-Worked Metals" $48,000 01-02
B. G. Ricketts
structure of plastically deformed and annealed metals, texture, recrystallization, Al Ag Fe in Al, effects of stacking faults

63. "Nuclear Magnetic Resonance Studies" $65,000 01-02
T. J. Rowland
diffusion, precipitation, melting, nuclear relaxation times, electric field gradients, Cr alloys, Al alloys, Knight shift

64. "Thin Films and Solid State Phase Transformations" $115,000 01-02
C. M. Wayman
growth and properties of metal films, vacuum evaporation, epitaxial growth, thermoelectric power measurements, phase transformations and superplastic behavior

65. "The Nature of Metallic Solid Solutions" $52,000 01-02
C. A. Wert
ordered structures in refractory metals, self diffusion, phase equilibria, Mössbauer effect, V Ta Nb Fe

Physics Department -02-
R. J. Maurer - Phone: 333-1370

66. "Use of Very High Pressure to Study the Structure of Matter" $93,000 02-02
H. G. Drickamer
pressures up to 300Kb, optical absorption, X-ray scattering, electrical resistance, Mössbauer effect, compounds of Fe, alloys of Fe and Co, organic crystals

67. "Anharmonic Effects in Solids" $107,000 02-02
A. V. Granato
equation of state, interatomic potentials, defects, elastic constants, high pressure and uniaxial stress, Al BaF_2 LiF Cu

68. "Defect and Electronic Properties of Solids" $117,000 02-02
D. Lazarus
thermal conductivity of solid He, mechanism of diffusion, effect of stress on Fermi surface, pressure effects, Soret effect

ILLINOIS, UNIVERSITY OF
Physics Department -02- (continued)

69. "Properties of Noble Gas Crystals" $97,000 02-02
R. O. Simmons
lattice dynamics and defect properties, X-ray scattering, ultrasonic velocity, laser light diffraction, isotopic effects

70. "Magnetic Resonance in Solids" $126,000 02-02
C. P. Slichter
influence of many body effects on the behavior of electrons in solids, impurity effects in Li Na, liquid alkali metals, second order transitions

71. "Physics of Refractory Metals" $40,000 02-02
W. S. Williams
mechanical thermal electrical properties, TiC ZrC NbC, C electro-migration, surface properties

72. "Effects of Irradiation on Materials, Defect Production and Annealing" $199,000 02-03
J. S. Koehler
electron and ion irradiation effects, resistivity, electron microscopy, channeling, anamolous X-ray transmission, Au Ag Ge Si

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

Inorganic Materials Research Division
L. Brewer - Phone: 843-6062
V. Zackay - Phone: 843-5531

73. "High Strength Materials" $180,000 01-01
V. F. Zackay
strength, ductility, toughness, corrosion, weldability, fatigue, acoustic emission, steel Ti Al, TRIP steel

74. "Development and Behavior of Microstructures in Ceramic Systems" $95,000 01-01
R. M. Fulrath
processing variables affecting microstructure, strength of glass, fracture, sintering, low temperature permeation of H and He

75. "Kinetics of Dislocation Mechanics" $145,000 01-01
J. E. Dorn
experiments from creep rates to impact rates, thermal activation analysis, theory, effect of C on Mo, Mg, Cu_3Au, AgMg, Fe-4%Si, BCC metals

76. "Fundamental Aspects of Strength and Toughness" $95,000 01-01
E. R. Parker
fracture toughness, ferrous, nonferrous, polymeric materials, effect of shock deformation on mechanical properties and defect structure (Ti-Al), W Al Fe

77. "Electron Microscopy and Field Ion Microscopy" $135,000 01-01
G. Thomas
structure of high strength steels, spinodal transformations, BCC solid solutions, A15 compounds (FIM), electron scattering phenomena, high voltage microscopy up to 650 Kv

78. "Ceramic Microstructure, Glass and Glass-Metal Systems" $160,000 01-01
J. A. Pask
diffusion, high temperature reactions, glass-metal interfaces, Al surface tension on Al_2O_3, MgO, creep of LiF, Fe-Glass

79. "Crystal Imperfections" $110,000 01-01
J. Washburn
radiation damage in Ir, twin boundary motion in Zn, explosive forming Cu, dislocation velocity in Si, X-ray topography, etch pit studies

920

LAWRENCE RADIATION LABORATORY
Inorganic Materials Research Division (continued)

80. "Thermodynamics of Metal Systems" $160,000 01-02
R. Hultgren

heats of formation, liquid metal solution calorimetry, low and high temperature heat capacities, compilation and critical evaluation of published thermodynamic data

81. "High Field Superconductivity" $140,000 01-02
L. Brewer, E. R. Parker, V. F. Zackay

structure and composition affecting J_c and H_c, flux pinning, Ti-Nb-Ta, Nb_3 (Ge,Al), Nb_3Sn-C, pulsed magnet to 300Kg

82. "High Temperature Reactions" $150,000 01-02
A. W. Searcy

equilibria and kinetics for vaporization and solid-gas reactions, mass spectrometry, torsion effusion, CrO_3 PrF_3 BeN AlS Zn LaF SnF_4 450

83. "Superconductivity in Alloy Systems" $100,000 02-02
M. Merriam

superconductivity transition temperatures as a method for studying Fermi surface-Brillouin zone interactions, Pb-In PbTl In-Mg In-Li In-Bi

84. "Theoretical Solid State Physics" $55,000 02-02
M. L. Cohen

electronic structure of solids, superconductivity in semiconductors and semimetals

85. "Magnetic Properties of Solids" $35,000 02-02
A. M. Portis

magnetic ordering, critical fluctuations near transitions, spin wave spectra, EPR, NMR, ferromagnetic alloys $CsMnF_3$, MnAu, Cu-Ni, Ni-Rh

86. "Far Infrared Properties of Solids" $80,000 02-02
P. Richards

far infrared spectroscopy of solids, Hg arc and laser, Ti and V in Al_2O_3, Fe in hemoglobin, solid H

87. "Experimental Solid State Physics and Quantum Electronics" $55,000 02-02
Y. R. Shen

optical properties, ultra short light sulses, transient phenomena, self trapping of laser beams, nonlinear optics

LAWRENCE RADIATION LABORATORY
Inorganic Materials Research Division (continued)

88. "Research on Superconductivity" $55,000 02-02
G. Rochlin
Josephson effect, gapless superconductivity, flux jumping in Type-II, tunneling experiments, organometallic compounds, Pb, cyclopentadiene compounds

NATIONAL BUREAU OF STANDARDS
Washington, D. C. 20234
Phone: 362-4040

89. "Constitution of Binary Alloys" $28,000 01-02

joint support of program to update reference on binary metallic systems, funded through NSRDC of NBS, work done at IITRI

90. "High Temperature Crystal Growth Techniques" $52,725 02-01
W. S. Brower
crystal growth and characterization, rf plasma technique, Chzochralski, X-ray and chemical etching for characterizing, TiO_2, ZrO_2, $CsPbCl_3$, $KTaO_3$, $LiMoO_3$, $LiNbO_3$

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

Metals and Ceramics Division -01-
J. H. Frye - Phone: 483-~~1154~~ 1554
B. S. Borie- Phone: 483-6764
C. J. McHargue - Phone: 483-1278

91. "Fundamental Ceramics Research" $36,000 01-01
W. Fulkerson
UN used as a model material for coordinated research program on physical properties, specific heat, sound velocity, band structure, thermal conductivity

92. "Physical Properties Studies" $180,000 01-01
D. L. McElroy, R. K. Williams, R. W. Williams
heat transport and absorption measurements, thermal conductivity, electrical resistivity, specific heat, electronic emittance, standards, radial heat flow and absolute longitudinal method

93. "Metallurgy of Superconducting Materials" $108,000 01-01
G. R. Love, C. C. Koch
phase diagrams, kinetics and morphology of precipitation, effects on Jc, Tc, Hc of structure, flux pinning, electron microscopy, ac and dc magnetization measurements, Tc-V, Tc-La, Tc-Ce, Nb-Ti, Nb-Zr

94. "Direct Observation of Lattice Defects" $73,000 01-01
J. O. Stiegler, K. Farrell, B. T. M. Loh
fracture under creep conditions, radiation - induced defects, precipitates, gas bubbles, slip, electron microscopy, W, vapor deposited W, BCC metals

95. "Physical Ceramics Studies" $108,000 01-01
C. S. Morgan, C. S. Yust
sintering, plastic deformation, creep, diffusion, ThO_2, UO_2

96. "Deformation of Crystalline Solids" $108,000 01-01
R. O. Williams, R. W. Carpenter, M. H. Yoo
effect of deformation on dislocation structure texture stored energy, precipitation, slip and twinning, thin film rolling Re, Ta-Hf, Nb-Hf, Al-Zn

97. "Deformation and Annealing of Metals" $73,000 01-01
C. J. McHargue, R. A. Vandermeer
polycrystalline - single crystal behavior, texture, recovery kinetics, Nb Cu Fe Cu_3Au Be

OAK RIDGE NATIONAL LABORATORY
Metals and Ceramics Division (continued)

98. "Reactions at Metal Surfaces" $144,000 01-01
J. V. Cathcart, R. E. Pawel
initial phases of oxidation, influence of strain, diffusion anodic film sectioning, high temperature oxidation, Nb Ta W Ni, single crystals

99. "Fundamental Research in X-Ray Diffraction" $120,000 01-02
H. L. Yakel, L. A. Harris, R. W. Hendricks, C. J. Sparks
application of X-ray diffraction to problems, structure, crystal perfection, clustering, ordering, radiation damage, Be oxides, graphite, Cu-Si, irradiated Al

100. "Theoretical Research" $115,000 01-02
H. L. Davis, J. S. Faulkner, H. W. Joy
band theory calculations, KKR method, magnetic properties, Fermi surface, exchange mechanisms, pressure effects, Cu Be UN KCl Al

101. "Electronic Properties of Metals and Alloys" $195,000 01-02
J. O. Betterton, G. Czjzek
low temperature specific heat, superconductivity, high field galvanomagnetic properties, Mössbauer effect, magnetic susceptibility, UN Zr Ni Ho ThN ZrN Hf

102. "Diffusion in Solids" $195,000 01-02
T. S. Lundy, D. K. Riemann
atomic migration in metals and ceramics, near surface effect, effect of stoichiometry, grain boundary and dislocation pipe diffusion, Nb Ta UN UO_2 Ag Au

103. "Spectroscopy of Ionic Media" $195,000 01-02
G. P. Smith, C. R. Boston, J. Brynestad
molten salts, electronic states, melting phenomena, coordination geometry, optical spectroscopy, binary chlorides, flourides, nitrates

Solid State Physics Division -02-
D. S. Billington - Phone: 483-6713

104. "Research and Development on Pure Materials" $685,000 02-01
J. W. Cleland, C. T. Butler, R. E. Reed, G. W. Clark, R. D. Westbrook
purification and crystal growth, characterization, analysis of composition and perfection, Research Materials Information Center, KCl MgO Ge Nb V W ThO_2 UO_2 Re

OAK RIDGE NATIONAL LABORATORY
Solid State Physics Division (continued)

105. "Spin Resonance" $100,000 02-02
M. M. Abraham, J. L. Kolopus
use of ESR to study local environment around paramagnetic impurities or difects, optical bleaching, thermal annealing, diamagnetic insulating oxides, halides, MgO ThO_2 CeO_2 BaS

106. "Neutron Spectrometry" $380,000 02-02
M. K. Wilkinson, H. G. Smith
ORR and HFIR neutrons, inelastic scattering from magnetic and nonmagnetic materials, critical scattering, small angle scattering with long wave length neutrons

107. "Superconductivity" $110,000 02-02
S. T. Sekula
effect of defects on properties, neutron irradiation plastic deformation precipitation, flux pinning, neutron irradiation of Nb, Nb-20%V, Nb-40%V

108. "X-Ray Diffraction" $80,000 02-02
T. O. Baldwin
deformed and neutron irradiated crystals, Borrmann effect, X-ray topography, neutron irradiated Cu at high temperatures, Cu Si Ge

109. "Defect Structures in Nonmetals" $256,000 02-02
W. A. Sibley, E. Sonder, Y. Chen
irradiated crystals, deformed crystals, ESR, optical absorption, luminescence, electron transport, insulators and semiconductors, KCl MgO ZnO MgF_2 LiF ZnF_2

110. "Neutron Diffraction" $385,000 02-02
M. K. Wilkinson, W. C. Koehler
magnetic structure, ordering, critical scattering, spin wave scattering, polarized beam neutrons, rare earths Fe Co Ni

111. "Low Temperature Physics" $120,000 02-02
W. T. Berg, D. Walton
thermal conductivity, adiabatic calorimetry, electronic specific heat, studies of defects and imperfections, Al Pt LiI MgO AgCl KCl LiF SiO_2

112. "Irradiation Effects in Thin Films and Foils" $95,000 02-03
F. W. Young, T. S. Noggle
electron microscopy, reactor and ion radiations, channeling, in situ damage, Au Cu Cd

OAK RIDGE NATIONAL LABORATORY
Solid State Physics Division (continued)

113. "Theory and Computations" $345,000 02-03
D. K. Holmes
radiation damage, channeling, spin wave theory, magnetic structure, electronic and vibrational structure of defects in ionic crystals

114. "Surface Study on Metals" $210,000 02-03
F. W. Young, L. H. Jenkins
surface reactivity, electrode kinetics, neutron irradiation effects, crystal structure effects, X-ray topography, Borrmann effect, dislocations, LEED, Cu Ag Brass

115. "Fundamental Studies of Elasticity and Anelasticity of Metals" $123,000 02-03
V. K. Pare
elastic constants, elastic nonlinearity, dislocations, annealing of defects, sound wave velocity, Cu

116. "Ion Bombardment" $75,000 02-03
B. R. Appleton
radiation effects, atomic potentials from channeling, stopping power, sputtering, ions - He Br I, Au crystals

117. "Radiation Effects at Low Temperatures" $321,000 02-03
R. R. Coltman
thermal neutron damage in metals, resistivity, superconductivity, Cd Al doped with U-235

PACIFIC NORTHWEST LABORATORY
Box 999
Richland, Washington 99352
Phone: Area Code 509 942-1111

118. "Transuranium Physical Metallurgy Research" $205,000 01-01
R. D. Nelson, S. D. Dahlgren, F. E. Bowman
plutonium and neptunium metallurgy, transformations, mechanical properties, superplasticity, sputtering, electron microscopy, high temperature metallography

119. "Radiation Effects in Metals" $195,000 01-03
T. K. Bierlein, J. L. Brimhall,
B. Mastel, H. E. Kissinger,
J. Kulcinski, F. A. Smidt
high temperature neutron radiation damage, structure, annealing, electron microscopy, X-ray diffraction, stored energy, resistivity, high pressure annealing, Ni Re Mo Fe

PUERTO RICO NUCLEAR CENTER
Caparra Heights Station
San Juan, Puerto Rico 00935
Phone: Area Code 809 767-0350

120. "Neutron Diffraction" $185,000 02-02
M. I. Kay
ferromagnetism, atomic and magnetic structures, inorganic salts, compounds

121. "Radiation Damage in Organic Crystals" $53,000 02-03
A. Cobas
electrical conductivity, optical properties, photoconductivity, flourescence, neutron gamma X-irradiation, anthracene, phenanthrene

SECTION B

University or Contract Research Program

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, UNIVERSITY OF

122. "Impurity Diffusion in Solids" — $69,600 — 02-02
C. T. Tomizuka - Department of Physics
pressure dependence, FCC BCC and HCP metals, alkali halides, Na, Mössbauer effect

123. "High Temperature Anneals of Defects Quenched in Metals" — $22,330 — 02-02
R. M. Emrick - Department of Physics
point defects, annealing of quenched metals, high temperatures, energy for vacancy motion, thermodynamic calculations

BOSTON UNIVERSITY

124. "Coincidence - Mössbauer Studies of Solid State Phenomena" — $27,890 — 02-02
G. R. Hoy - Department of Physics
cobalt compounds, Auger cascade, ionic spin relaxation, electric field gradient relaxation

BRANDEIS UNIVERSITY

125. "Experimental Studies of Critical Point Behavior in Magnetically Ordered Solids Using Nuclear Gamma-ray Spectroscopy, and Related Experiments" — $30,871 — 02-02
C. Hohenemser - Department of Physics
temperature dependence of internal magnetic fields in ferromagnetic materials, nuclear lifetime measurements

126. "Low Temperature Properties of Solid Helium" — $33,903 — 02-02
H. D. Cohen - Department of Physics
magnetic susceptibility, specific heat, very low temperatures, phase separation, solid He-3 and alloys of He-3 with He-4

BRIGHAM YOUNG UNIVERSITY

127. "Thermodynamic Investigation of Alkali Metal Mixtures" — $43,976 — 01-02
J. B. Ott and J. R. Goates - Dept. of Chemistry
solid-liquid phase equilibria, compound formation, solid transformations, Na K Rb Cs alloys

BROOKLYN, POLYTECHNIC INST. OF

128. "Study of Binary Multiphase Diffusion in Metallic Systems" — $22,158 — 01-02
L. S. Castleman - Department of Physical and Engineering Metallurgy
mechanisms that control origin structure and morphology of nonplanar phase interfaces, diffusion, Al-Sb, U-Al

BROWN UNIVERSITY

129. "Radiation Damage Studies in Solids Using Magnetic Resonance Techniques" — $71,164 — 02-03
P. J. Bray - Department of Physics
ESR, NMR, optical absorption, irradiated glasses, borate, niobate, titanate and germanate glasses

130. "A Combined Macroscopic and Microscopic Approach to the Mechanical Properties of Metals" — $106,972 — 01-01
J. Gurland and D. C. Drucker - Division of Engineering
brittle and ductile fracture, dislocations, continuum mechanics embrittling parameters, multiphase alloys, carbon steels

CALIFORNIA INSTITUTE OF TECHNOLOGY

131. "Studies of Alloy Structure and Properties" — $207,400 — 01-02
P. Duwez - Department of Engineering
metastable alloys by quenching from liquid state, ferromagnetism, superconductivity, kinetics of transformation, X-ray diffraction, electron microscopy, resistivity, Mossbauer effect, Pd-Si Fe alloys (P,C), Te alloys

132. "Dislocation Mobility and Density in Metallic Crystals" — $75,000 — 01-01
D. S. Wood and T. Vreeland, Jr. - Laboratory of Engineering Materials
dislocation velocity, stress and temperature dependence, impurity effects, X-ray topography, Al Zn Fe Cu

CALIFORNIA, UNIVERSITY OF

133. "Dynamic Nuclear Polarization and Solid State Physics" — $35,600 — 01-01
C. D. Jeffries - Department of Physics, Berkeley
methods of nuclear polarization, spin-phonon dynamics, rf microwave and optical spectroscopy of paramagnetic ions, optical pumping of magnetic crystals, nitrates, ethyl sulfates

CALIFORNIA, UNIVERSITY OF (continued)

134. "Electric and Magnetic Properties of Transition Metals and Their Compounds" — $67,582 — 02-02
A. W. Lawson - Department of Physics, Riverside
line width and spin wave relaxation, antiferromagnetic resonance, electrical and magnetic properties, pressure dependence, EuS EuTe IrO_2 RuO_2 Gd EuO TbAs TbSb EuSe EuTe

135. "Electroabsorption Studies in Semiconductors" — $25,339 — 02-02
M. Chester - Dept. of Physics, Los Angeles
optical absorption in an electric field, HgI_2

136. "Research on the Properties of Materials at Very Low Temperatures" — $145,939 — 02-02
J. C. Wheatley - Dept. of Physics, San Diego
very low temperatures (2 millidegrees), superconductivity, magnetism, NMR, heat capacity, low temperature thermometry, thermal conductivity, spin waves, viscosity, liquid and solid He-3 He-4

137. "New Materials by Low Temperature Condensation" — $53,000 — 01-01
Huey-Lin Luo - Department of Applied Electrophysics, San Diego
sputtering, magnetic and electrical properties, superconductivity, Nb_3 (Al,Ge), carbides

CARNEGIE-MELLON UNIVERSITY

138. "Stability of Alloy Phases" — $39,000 — 01-02
T. B. Massalski - Metal Physics Group
theory of alloy phases, low temperature specific heat, HCP and FCC intermediate phases, Cu-Ge, Cu-Si, Ag-Al, Cu-Zn

139. "Application of the Mössbauer Effect to the Study of Metallic Solid Solutions" — $6,865 — 01-02
P. A. Flinn - Physics and Metals Res. Lab.
transformations in Fe-C alloys, carbon diffusion, noble metal alloys, electronic structure

CASE WESTERN RESERVE UNIVERSITY

140. "Solid State Transformations in Zirconium, Hafnium and Titanium Alloys" — $25,395 — 01-01
R. F. Hehemann - Dept. of Metallurgy
omega phase, x-ray diffraction, electron microscopy, beta stabilized Zr Ti Hf alloys, TiNi

CASE WESTERN RESERVE UNIVERSITY (continued)

141. "Solid State Physics" $73,120 02-02
R. W. Hoffman - Department of Physics
internal stresses and magnetization in thin films, electron microscopy and diffraction, Mossbauer effect, FCC metals on NaCl substrates, pressure dependence of elastic constants, equation of state, alkali halides

142. "Dislocation-Solute Atom Interactions in Alloys" $31,000 01-01
R. Gibala, Department of Metallurgy
strengthening mechanisms, anelastic techniques, interstitials, dislocation damping, austenitic Fe-Ni-C alloys, BCC metals (Nb), Nb-V Nb-Mo Nb-Zr

CHICAGO, UNIVERSITY OF

143. "Interactions on Metallic Surfaces" $44,534 02-02
R. Gomer, Department of Chemistry and Institute for the Study of Metals
adsorption studies on single crystal metal surfaces, FEM, FIM, work function, crystallographic dependence, CO on W, H on Pt, mass spectrometry of isotope mixing

CLARKSON COLLEGE OF TECHNOLOGY

144. "The Oxidation of Copper Films" $18,662 02-02
A. W. Czanderna, Department of Physics
oxidation, optical constants, films, stoichiometric effects, cupric oxide

CLEMSON UNIVERSITY

145. "Radiation Effects in Crystalline Materials" $37,657 02-03
R. L. Chaplin, Department of Physics
electron irradiation, annealing of damage, liquid helium temperature, crystallographic effects, Al, Mg, Ti

COLUMBIA UNIVERSITY

146. "Defects in Crystals" $48,746 01-02
A. S. Nowick, Engineering and Applied Science
point defects, relaxation phenomena, anelastic and dielectric techniques, noncubic crystals, Cu_2O, SiO_2

147. "A Study of the Feasibility of Obtaining Field Ion Microscope Images of Interstitial Solutes" $25,000 01-02
E. S. Machlin, Department of Metallurgy
concentration and structures of solute-oxygen complexes using FIM, statistical thermodynamics, binding energies, W-O system with Os, Ta or Re

CONNECTICUT, UNIVERSITY OF

148. **"Investigation of Radiation Effects in Solids by Electron Spin Resonance"** $28,000 02-03
O. R. Gilliam, Department of Physics
ESR, optical absorption, irradiations with electrons, neutrons, gammas and ultraviolet light, alkali azides, cyanates flourides, Al_2O , $CaMo_4$, $CaWO_4$

149. **"Theoretical Investigations of Radiation Effects in Ionic Crystals"** $17,306 02-03
R. H. Bartram, Department of Physics
theory of ionic crystals, radiation effects, band structure

CORNELL UNIVERSITY

150. **"Solid State Physics: Magnetic Phenomena"** $113,400 02-02
R. H. Silsbee and R. Bowers - Department of Physics
application of microwave resonance and optical absorption to studies of defects and magnetic phenomena, ESR, alkali halides, HCN^- and FCN^- in KCl, O_2 in KI, Li^+ in KCl

151. **"Experimental Phonon Physics"** $148,370 02-02
J. A. Krumhansl, R. O. Pohl, A. J. Sievers - Laboratory of Atomic and Solid State Physics
lattice vibrations in defect solids, impurity modes, interatomic forces, phonon-phonon and phonon-defect interactions, band gap in superconductors, far infrared absorption

152. **"A Study of Imperfections in Crystals"** $64,430 02-02
H. S. Sack, Department of Engineering Physics
paraelectric and paraelastic impurities such as Li^+ CN^- F^- NO_2^- in alkali halides, dielectric and anelastic techniques, internal friction in metals, Al, x-ray topography

153. **"Elastic and Plastic Deformation of Solids"** $118,400 01-01
A. L. Ruoff, Department of Materials Science and Engineering
pressure derivatives of elastic constants and creep, nuclear magnetic spin relaxation, diffusion, K Na, Li halides, Rb halides, Cu Ag Au

154. **"Hard Superconducting Materials"** $85,917 01-02
J. Silcox and W. W. Webb, Department of Applied Physics
magnetic hysteresis, critical current densities, instabilities, fluxoid motion, phase transition, Nb

CORNELL UNIVERSITY (continued)

155. **"Correlation of Physical Properties of Crystals with Microstructure"** $ 3,770 01-02
J. Silcox, Department of Engineering Physics
ferromagnetic domain structure, in situ electron microscopy at liquid He temperature, Gd Dy Ni

156. **"Solid Liquid Interface"** $25,986 01-02
Che-Yu Li, Department of Materials Science and Engineering
liquid Li penetration into Nb bicrystals

157. **"Theory of Slow Neutron Inelastic Scattering by Liquids"** $45,120 02-02
M. Nelkin, Department of Engineering Physics
structure motion and forces in liquids and dense gases, theory, density-density correlations

158. **"Electronic Properties of Defects in Ionic Crystals"** $36,642 02-02
D. B. Fitchen, Department of Physics
dynamic behavior of color centers in alkali halides, electron-phonon interactions, Jahn-Teller effect, Stark effect, magneto-optic studies

159. **"Defects in Metal Crystals"** $152,948 01-03
R. W. Balluffi and D. N. Seidman - Department of Materials Science and Engineering
radiation damage and defects, ion accelerator, FIM, quenched Au Pt, interstitials, channeling, dislocation pipe diffusion, Au Al W Pt

160. **"Theoretical Phonon Physics"** $57,503 02-02
J. A. Krumhansl and P. Carruthers, Laboratory of Atomic and Solid State Physics
atom motions in condensed matter, phonons in disordered systems, interacting phonons and phase transitions, tunneling of atoms and ions, liquid and solid helium

161. **"Effect of Environment on Fracture Behavior"** $36,408 01-01
H. H. Johnson, Department of Materials Science and Engineering
crack growth rate, critical stress intensity, electron microfractographic analysis, hydrogen diffusivity and distribution, high strength steels in an environment of H_2O H H-O mixture

CORNELL UNIVERSITY (continued)

162. **"Radiation Damage Studies Using the Cornell 3.0 MeV Dynamitron Accelerator"** — $52,437 — 02-03
A. Taylor, Department of Materials Science and Engineering
monoenergetic neutrons 100-500 Kev, annealing spectrum of thermally stimulated conductivity, lattice defects, NaCl KBr

163. **"Studies of Low Temperature Phase Transformations in High Field Superconductors"** — $37,290 — 01-02
B. W. Batterman, Department of Materials Science and Engineering
low temperature crystal structure transformation, microscopy, thermal diffuse x-ray scattering to determine phonon frequencies, V_3Si Nb_3Sn V-H

DELAWARE, UNIVERSITY OF

164. **"Radiation-Induced Defects in Alkali Halides, and Their Role in Recombination Processes"** — $28,905 — 02-03
R. B. Murray, Department of Physics
V_k center and excited states produced by recombination of f electrons with V_k, mechanism for anion vacancy formation, luminescence

FLORIDA, UNIVERSITY OF

165. **"Topological Study of the Sintering Process"** — $40,816 — 01-01
F. N. Rhines and J. Kronsbein and R. T. De Hoff, Metallurgical Research Laboratory
structure evolution, particle size distribution, kinetics of densification, surface tension related to sintering force

166. **"Deformation Processes in Hexagonal Metals"** — $24,734 — 01-01
R. E. Reed-Hill, Metallurgical and Materials Engineering
flow stress vs strain rate and temperature down to $4^{o}K$, abnormality in flow stress at 500-700^{o}K, strain aging, Ti Zr

FRANKLIN INSTITUTE

167. **"A Study of Non-Stoichiometry in Carbides by Field Ion Microscopy"** — $34,930 — 01-01
J. D. Meakin, Department of Materials Science and Engineering
computer simulation, position of C in compounds using FIM, TaC Ta silicides

GEORGIA INSTITUTE OF TECHNOLOGY

168. **"Surface Properties of Magnetic Materials"** $54,473 02-02
E. J. Scheibner, Engineering Experiment Station
elastic and inelastic scattering of low energy electrons, scattering mechanisms, adsorbed gases, electron spectroscopy, W Cu Ni Si

169. **"Magnetic Phenomena at Metal Surfaces"** $38,346 01-02
S. Spooner, Department of Chemical Engineering
neutron scattering, magnetic metal surfaces, torque magnetometer measurements on thin films, neutron spin polarization, domain structure Co Co-6%Fe

GEORGETOWN UNIVERSITY

170. **"The Study of Very Pure Metals at Low Temperatures"** $50,758 02-02
W. D. Gregory, Department of Physics
effect of boundary scattering on superconductivity, superconducting tunneling, isotope effect, Ga

ILLINOIS INSTITUTE OF TECHNOLOGY

171. **"Investigation of Energy Transfer Processes by Flash Photolysis"** $26,582 02-02
L. I. Grossweiner, Department of Physics
mechanism of optical conversion of F centers to R and M centers in KCl with repetitive light pulse methods, mechanism of sensitized photoconductivity in ZnO films

172. **"Thermal Measurements on Solids Below $1^{o}K$"** $41,000 02-01
H. Weinstock, Department of Physics
application of thermal conductivity and specific heat measurements to radiation damage and defects, alkali halides, spin waves in ferromagnetic and antiferromagnetic materials

173. **"Effects of Combined Stress on the Fracture Strengths of Brittle Ceramic Materials"** $35,000 01-01
L. J. Broutman, Department of Mechanics
failure envelope for alumina and graphite under combined states of stress, thin walled cylinders pressurized inside and outside to provide tension-tension and compression-tension states

JOHNS HOPKINS UNIVERSITY

174. **"Phonon Imprisonment Studies"** $33,981 02-02
P. E. Wagner, Department of Electrical Engineering
phonon avalanche process, detect phonons by Brillouin scattering of laser light, detect phonons by absorption in paramagnetic species

KANSAS, UNIVERSITY OF

175. **"Experimental and Theoretical Studies of Magnetic Resonance and Relaxation"** — $31,200 — 02-02
P. M. Richards, Department of Physics and Astronomy
nuclear and electronic spin waves, $RbMnF_3$, spin lattice relaxation and line width in paramagnetic salts, theory of ferromagnetic resonance line width(Ni)

KENTUCKY, UNIVERSITY OF

176. **"Radiation Effects on Germanium"** — $30,667 — 02-03
B. R. Gossick, Department of Physics and Astronomy
electron and hole mobilities in n-type Ge, ac measurements of Hall effect, lattice disorder, quenching studies

LEHIGH UNIVERSITY

177. **"Strength and Structure in Cyclically Transformed Fe-Ni-C Alloys"** — $13,500 — 01-01
G. Krauss, Jr., Department of Metallurgy and Materials Science
vary the carbide and dislocation structure by cyclic transformation austenite-martensite, wire samples, electron microscopy, Fe-Ni-C

LOUISIANA STATE UNIVERSITY

178. **"Conductivity Tensors in Metals and Semiconductors"** — $73,492 — 02-02
J. M. Reynolds, Department of Physics and Astronomy
magnetoresistance, Hall effect, magnetothermal effects, magnetic breakdown, electron-phonon scattering, semiconductors, metals

MARQUETTE UNIVERSITY

179. **"Defect Structures in Nonstoichiometric Oxides"** — $29,373 — 01-02
R. N. Blumenthal, Department of Mechanical Engineering
pressed and sintered CeO_2, defects, thermodynamics, electrochemical cell and thermogravimetric method, electrical conductivity, up to 1500°C

MARYLAND, UNIVERSITY OF

180. "Conduction Electrons and Magnetism" $34,317 02-02
J. R. Anderson and S. M. Bhagat
Department of Physics and Astronomy
relationship between electronic structure and magnetism, Fermi surface studies using ferromagnetic resonance (fmr), measure fmr linewidth, de Haas van Alphen effect, Co Gd

181. "An Investigation of Solid Solution Hardening in Metallic Solid Solution Alloys" $17,960 01-01
R. M. Asimow, Department of Mechanical Engineering
CRSS of FCC solid solution crystals, statistical approach to motion of dislocations through random solid solutions, substructure and short range order, Ag-Au

182. "An Investigation of Irradiation Strengthening of b.c.c. Metals and Solid Solutions" $30,990 01-03
R. J. Arsenault, Department of Chemical Engineering
neutron damage, rate controlling mechanism of slip, differential strain rate and differential temperature tests, V V-Ti

183. "The Galvanomagnetic Properties of Graphite in the Temperature Range 4-300°K and Pressure Range 0-10,000 kg/cm^2" $33,450 01-01
I. L. Spain, Inst. for Molecular Physics
carrier density and mobility as a function of temperature and pressure, synthetic and natural graphite, Hall effect, magnetoresistance

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

184. "Low Temperature Neutron Physics Studies" $111,260 02-02
C. G. Shull, Department of Physics
electron spin pairing in superconducting V by coherent paramagnetic scattering of polarized neutrons, electric dipole moment of neutron, neutron intensity from (222) reflection of Ge

185. "Basic Research in Ceramics and Non-crystalline Systems" $274,708 01-01
W. D. Kingery and R. L. Coble, Department of Metallurgy
structure, diffusion, sintering, mechanical properties, oxygen permeation through polycrystalline oxides, creep in Al_2O_3 SiC, grain growth, crystallization and melting kinetics

MASSACHUSETTS INSTITUTE OF TECHNOLOGY (continued)

186. **"Mechanical Properties of Metals at Low Temperatures"** $18,400 01-01
W. A. Backofen, Department of Metallurgy
temperature dependence of crystallographic shear, shear fracture of polycrystalline Zr Mg, single crystals and textured Zircaloy-4, temperatures up to 800°C

MICHIGAN STATE UNIVERSITY

187. **"Studies of Electrical and Defect Properties of Thin Metallic Wires"** $34,304 02-02
J. Bass, Department of Physics & Astronomy
quenching into superfluid helium, motion and formation energies of vacancies, effects of specimen size, effect of magnetic field on thermopower of Al, Pt W V Ta Mo

188. **"Study of Interactions between f-Shell Transition Ions in Non-metallic Crystals"** $29,885 02-02
E. H. Carlson, Department of Physics
super exchange interactions, magnetic ordered states, internal fields as a function of temperature, NMR, $GdCl_3$ $PrCl_3$

189. **"Properties of Rare-Gas Solids"** $29,418 02-02
G. L. Pollack, Department of Physics and Astronomy
thermodynamics, surface physics, vacancy and defect structure, vapor pressure, interatomic forces, A Kr Xe Ne

MICHIGAN TECHNOLOGICAL UNIVERSITY

190. **"Structure and Properties of Solid Solutions"** $43,093 01-01
A. A. Hendrickson, Department of Metallurgical Engineering
strain rate and temperature dependence of flow stress, FCC and BCC solid solutions, thermal activation energies, solute-dislocation interaction energies, Ag alloys, Nb-Mo

191. **"Effect of Annealing on the Substructure of Cold Worked fcc Metals and Alloys"** $32,329 01-02
D. E. Mikkola, Department of Metallurgical Engineering
x-ray diffraction and electron microscopy, kinetics of antiphase domain coalescence (Cu_3Au), stacking fault effects, Cu-Ge

MICHIGAN, UNIVERSITY OF

192. **"Thermodynamic Activities in Solid Alloys"** $29,520 01-02
R. D. Pehlke, Department of Chemical and Metallurgical Engineering
solid oxide electrolyte technique, Fe-Cr, Ni-Cr

MINNESOTA, UNIVERSITY OF

193. **"Diffusion Studies in Liquid Metals"** $47,915 01-02
R. A. Swalin, Department of Mineral and Metallurgical Engineering
self diffusion and tracer diffusion in liquid metals, Soret effect, radial distribution functions, constant volume conditions, Na Ag

194. **"Effect of Short-Range Order on the Mechanical Properties of Alloys"** $22,000 01-01
M. E. Nicholson, Department of Mineral and Metallurgical Engineering
mechanical properties as a function of short range order, overshooting in single crystals, Bauschinger effect, 45% Pd-Au

195. **"Experimental and Theoretical Studies in Solid State and Low Temperature Physics"** $161,112 02-02
W. Zimmerman, Jr. and L. H. Nosanow, School of Physics
superconductivity, Josephson effect, quantum effects near transition, quantum crystals(theory), magnetic properties of He-3, superfluidity, magnetic properties of Mn-Cr-Sb. heavy rare earths Co alloys

196. **"A Study of Grain Boundary Segregation Using the Auger Electron Emission Technique"** $26,541 01-01
D. F. Stein, School of Mineral and Metallurgical Engineering
application of Auger electron emission to detection of embrittling agents at grain boundaries, Fe-P, Fe-O

197. **"In Situ Electron Microscope Investigation of the Nucleation and Growth of Sputtered Thin Films"** $66,814 01-01
T. E. Hutchinson, School of Mineral and Metallurgical Engineering
sputtered film nucleation versus vapor deposited, atom energy and ionization parameters, Si Nb Au . CdS on substrates of mica amorphous carbon graphite

MISSISSIPPI, UNIVERSITY OF

198. **"The Effects of Neutron Irradiation on the Binary Alloys"** — $37,450 — 02-03
A. B. Lewis, Department of Physics and Astronomy
neutrons produced from target reaction 3MeV dynamitron, resistivity effects, Cu alloy single crystals

MISSOURI, UNIVERSITY OF

199. **"Ferroelectric Properties of Bismuth Ferrate and Related Materials"** — $40,388 — 02-02
R. Gerson and W. J. James, Department of Physics
magnetic susceptibility, neutron diffraction, Mössbauer effect, conductivity, single crystals, $BiFeO_3$, $BiFeO_3$-$PbTiO_3$

200. **"Nuclear Radiation Effects on Silicon P-N Junctions"** — $48,404 — 02-03
C. A. Goben, Department of Nuclear Engineering
neutron induced current component, anomalous annealing of the recombination generated sites, field dependence, V-I characteristics, high current levels

MONTANA STATE UNIVERSITY

201. **"An Investigation of Turbulent Flow in a Rough Pipe"** — $27,010 — 01-01
H. W. Townes, Department of Mechanical Engineering
heat transfer coefficient between solid surface and moving fluid (air)

MURRAY STATE UNIVERSITY

202. **"Interaction of Fission Fragments with Thin Films"** — $25,470 — 02-03
L. Bridwell, Department of Physics
Cf-252 fission fragments, mechanism of heavy ion kinetic energy losses, secondary electron production

NEBRASKA, UNIVERSITY OF

203. "Studies of Imperfections in Solids" $40,039 02-02
E. A. Pearlstein - Department of Physics
differential thermal analysis, irradiated alkali halides, optical absorption, NaCl

NEW YORK UNIVERSITY

204. "Study of Subtractive Phases in the Transition Metal-Tellurium Systems" $27,573 01-02
E. Miller - Department of Metallurgy and Materials Science
atom interaction energies in binary systems, thermodynamics, electronic properties, electronic energy levels and bonding in compounds, Co-Te Ni-Te Fe-Te

NORTH CAROLINA STATE

205. "The Effects of Radiation and Gas Concentration on Rare Gas Diffusion in Solids" $23,992 01-03
T. S. Elleman - Department of Nuclear Engineering
kinetics of Xenon gas release from CsI, single crystals doped a variety of ways, effects of radiation damage

206. "Grain Boundary Sliding in Alumina Bicrystals" $31,694 01-01
H. Palmour III - Department of Engineering Research
grain boundary strength and deformation modes, effect of impurity doping (R.E. oxides), grain boundary migration

NORTH CAROLINA, UNIVERSITY OF

207. "Atomic Diffusion in Crystals" $33,399 02-02
L. Slifkin - Department of Physics
tracer diffusion in Al, diffusion in AgCl AgBr MgO, electrical resistivity, EPR, defects

208. "Investigation of Defect Structures by Electric Polarization and Relaxation Methods" $25,923 02-02
J. H. Crawford, Jr. - Department of Physics
dipolar imperfections, radiolysis, transport behavior, dielectric relaxation, optical absorption, dc polarization, X-rays gammas electrons, alkali halides

NORTH CAROLINA, UNIVERSITY OF (continued)

209. "Pressure Variation of Single Crystal Elastic Constants" — $24,611 — 02-02
C. S. Smith - Department of Physics
pressure variation of elastic constants, Rb halides

NORTH DAKOTA, UNIVERSITY OF

210. "Physical Phenomena in Crystals Consisting of a Finite and Countable Number of Atoms in One Direction" — $44,425 — 02-02
H. H. Soonpaa - Department of Physics
electrical transport phenomena, optical absorption, X-ray diffraction, $Bi_8Te_7S_5$ - can cleave in very thin films with atomically smooth and parallel surfaces, size effects

NORTHEASTERN UNIVERSITY

211. "Calorimetric Studies of the Proximity Effect in Superconductors" — $32,554 — 02-02
C. A. Shiffman - Department of Physics
measure the excess ordering associated with the proximity effect, electronic mean free path, eutectic alloys Pb-Sn

NORTHWESTERN UNIVERSITY

212. "Radiation Effects of Ion Bombardment" — $32,363 — 02-03
R. L. Hines (A. W. Ewald, Acting P.I.)- Department of Physics
imperfection clusters produced in thin crystal foils, energy losses, electron microscopy, H, D, He ions, Au foils

213. "Studies of Radiation Damage Resulting from Electron Bombardment" — $41,113 — 02-03
J. W. Kauffman - Department of Materials Science
recovery kinetics in Cu, Au, resistivity, interstitials, Stage I recovery

214. "Effect of Point Defects on Mechanical Properties of Metals" — $39,383 — 01-01
M. Meshii - Department of Materials Science
electron irradiations, 2 MeV electrons, mechanical testing down to 20°K, quenching in vacancies, dislocation interactions, Al BCC metals

NOTRE DAME, UNIVERSITY OF

215. "Magnetoelastic Phenomena in Metals" $5,072 01-02
B. D. Cullity - Department of Metallurgical Engineering and Materials Science
measure residual macrostress in steel rods, ac magnetic induction

OHIO STATE UNIVERSITY

216. "An Investigation of Mixed Conduction in Solid Electrolytes" $31,446 01-02
R. A. Rapp - Department of Metallurgical Engineering
mechanism of conductivity, defect mobilities, use of solid state electrolytes to study thermodygamics of quartz UO_2, 2-probe ac and dc polarization measurements, ThO_2 doped with La_2O_3, Sm_2O_3, Gd_2O_3, Dy_2O_3

OKLAHOMA, UNIVERSITY OF

217. "Formation Energies of Individual Vacancies in Alkali Halides" $10,505 02-02
C. A. Plint - Department of Physics
light scattering, temperature dependence of potential difference produced across crystal faces subjected to deformation, KCl, LiF

218. "The Effects of Surface Coatings on The Plastic Deformation of Metal Single Crystals" $26,220 01-01
R. J. Block - Department of Chemical Engineering and Materials Science
relation of coating properties and induced strain on strength of single crystals, dislocation density measurements by etch pitting, Al, Cu

OREGON STATE UNIVERSITY

219. "The Electronic Properties of Liquid Semiconductors" $12,247 02-02
M. Cutler - Department of Physics
electronic structure, Hall coefficient, thermoelectric power, Tl-Te alloys

PENNSYLVANIA STATE UNIVERSITY

220. "Research on Graphite" $109,674 01-01
P. L. Walker, Jr. - Department of Fuel Science and Nuclear Engineering
pyrolysis over metal substrates, CO disproportionation, microscopy of defects, fission recoil damage, Xe release, neutron damage-internal friction

221. "Thermodynamic Properties of Solid Solutions at High Temperatures" $29,788 01-02
A. Muan - Department of Geochemistry and Mineralogy
thermodynamics of inorganic materials at elevated temperatures, activities, compound formation, titanates, nitrides, carbides

222. "Transformations in AB_2 Intermetallic Compounds" $28,450 01-02
E. Ryba - Department of Metallurgy
structural transformations and electronic structure of R.E.-Cu_2 and -Zn_2 compounds, magnetic susceptibility, x-ray diffraction, pseudobinary diagrams, elastic constants

223. "Nonlinear Elastic and Thermoelastic Properties of Materials" $42,999 02-02
G. R. Barsch - Materials Research Lab.
pressure dependence, third order elastic constants, nonlinearity of interatomic forces, uranium compounds, alkali halides, phonon dispersion relations

PITTSBURGH, UNIVERSITY OF

224. "Magneto-thermodynamics of Para- and Antiferromagnets" $43,178 02-02
R. A. Butera - Department of Chemistry
exchange interaction, cooperative magnetic phenomena at very low temperatures, large volume high field superconducting magnet, $MnBr_2 \cdot 4H_2O$, magnetic susceptibility

225. "Thermal, Structural and Magnetic Studies of Metals and Intermetallic Compounds" $97,834 02-02
W. E. Wallace and R. S. Craig - Dept. of Chemistry
rare earth intermetallic compounds, constitution and magnetic behavior, low temperature specific heat, pseudo-binary diagrams, Laves phases

PITTSBURGH, UNIVERSITY OF (continued)

226. "A Study of Radiation Induced Defects in Metals" — $30,118 — 02-03
J. R. Townsend - Department of Physics
elastic constants, internal friction, elastic bulk effect, 10-15 MeV protons, Cu W, theory

PURDUE UNIVERSITY

227. "Basic Radiation Damage Studies" — $73,782 — 02-03
J. W. MacKay - Department of Physics
electron irradiation, Hall effect, conductivity, photoconductivity, optical absorption, defect annealing, x-ray determinations of volume changes, Ge Si

228. "Transport and Thermodynamic Properties of Solids" — $28,953 — 01-02
R. E. Grace - Department of Metallurgical Engineering
diffusion in ternary alloys and multicomponent oxides, lattice defects, conductivity, Seebeck coefficient, electron microprobe analysis, Ag-Cd-Zn, Cu-Zn-Mn, Cu-Zn-Ni, $CaTiO_3$, $SrTiO_3$

229. "Mössbauer Studies of the Properties of Solids" — $29,960 — 02-02
J. G. Mullen - Department of Physics
magnetic and quadrupole hyperfine interactions, properties associated with stoichiometric defects, transition metal oxides and halides, CoO, NiO, $CoCl_2$, CoF_2

230. "Diffusion and Precipitation of Inert Gases in Metals" — $32,791 — 01-03
J. R. Cost - School of Materials Science and Metallurgical Engineering
alpha particle irradiations, internal friction, x-ray diffraction, He in Al and Nb

QUEENS COLLEGE/CITY UNIVERSITY OF NEW YORK

231. "Theoretical Research on Radiation Induced Defects in LiH" — $39,839 — 02-03
R. D. Hatcher - Department of Physics
defects, relaxation of nearby ions, migration, theory, LiH, LiH containing tritium

RENSSELAER POLYTECHNIC INSTITUTE

232. "Anisotropic Diffusion and Electromigration" — $59,000 — 02-02
H. B. Huntington - Department of Physics
electromigration, thermomigration, diffusion in non-cubic metals where effect is anisotropic, Zn Mg Cd Ti Na-K

233. "Theoretical Research on Electron Behavior in Crystals" — $24,800 — 02-02
E. Brown - Department of Physics
electronic states in crystals, magnetic field effects, Cu

234. "Precipitation and Dispersion Hardening in Magnesium-Base Alloys" — $20,000 — 01-01
N. S. Stoloff - Department of Materials Engineering
fracture, effect of particle type and size, void formation, hydrided Hf, Mg-Th-Zr, Mg-Zr, Hf

235. "Effect of Hydrostatic Pressure on Self-Diffusion Rates in Hexagonal Metals" — $32,000 — 02-02
H. M. Gilder - Department of Physics
activation volume, high pressure gas system, Zn Cd Tl

236. "Research in Powder Metallurgy" — $32,000 — 01-01
F. V. Lenel - Department of Materials Engineering
mechanism of sintering, kinetics of densification, properties of compacts, one-two-three dimensional powder arrays, Zn Cu

RHODE ISLAND, UNIVERSITY OF

237. "Measurement of Frequency Spectra of Normal Modes by Means of Inelastic Neutron Scattering from Oriented Single Crystals" — $44,718 — 02-02
J. S. Desjardins and S. S. Malik - Department of Physics
neutron inelastic scattering, phonon spectra

ROCHESTER, UNIVERSITY OF

238. "Electron Spin Resonance in Solids" $47,814 02-02
T. G. Castner - Department of Physics and Astronomy
uniaxial stress dependence of spin-lattice relaxation for P and As in Si, ENDOR and spin-lattice relaxation of O_2^- ion in alkali halides, paramagnetic line width and antiferromagnetic resonance

RUTGERS UNIVERSITY

239. "Relaxation Behavior, Molecular Motion and Structure in Polymers and Related Materials" $29,962 01-02
J. A. Sauer - Department of Mechanics
mechanical and thermal behavior of high polymers, electron irradiation, single crystals, high pressure structure formation, poly-alpha-olefins, polystyrene

ST. MARY'S COLLEGE, Minnesota

240. "Experimental Study of the Surface Structure and Electronic Properties of Single Crystal Molybdenum and Tungsten Ribbons" $13,700 02-02
D. R. Morgan and W. E. Blass - Department of Physics
electron emission properties of W and Mo single crystal surfaces, effect of O and CO_2 adsorption on LEED pattern

STANFORD UNIVERSITY

241. "Thermodynamic Properties and Defect Structure of Intermetallic Compounds" $29,000 01-02
D. A. Stevenson - Department of Materials Science
II-VI compounds, defect equilibria, diffusion, Hall coefficient, precipitate morphology, conductivity

242. "Effect of Point Defects on Mechanical Behavior of Crystalline Solids" $19,000 01-01
O. D. Sherby and O. C. Shepard - Dept. of Materials Science
superplastic behavior of Al-Zn alloys, creep,diffusion

STANFORD UNIVERSITY (continued)

243. "Structure Dependence of High Temperature Deformation of Metals" — $38,750 — 01-01
C. R. Barrett and W. D. Nix - Department of Materials Science
high temperature-low stress creep, dislocation motion, shock deformation effects on primary creep, Al Ni base alloys

SYRACUSE UNIVERSITY

244. "In Situ Ultra High Vacuum High Energy Electron Diffraction Studies" — $27,818 — 01-02
R. Vook - Department of Chemical Engineering and Metallurgy
construct HEED apparatus, nucleation and growth of films, metal epitaxy on alkali halide substrates

TEMPLE UNIVERSITY

245. "A Study of the IB-IIB Beta Phase Alloys" — $97,500 — 01-02
L. Muldawer and H. Amar - Dept. of Physics
experiments on Cu-Au and Cu-Zn systems, transformations, optical properties, theory on electronic structure, superlattices, transport properties

TENNESSEE, UNIVERSITY OF

246. "Application of Adiabatic Calorimetry to Metal Systems" — $21,990 — 01-01
E. E. Stansbury and C. R. Brooks - Dept. of Chemical and Metallurgical Engineering
heat capacity of Pt Au W Cu stainless steel Al_2O_3, cooperative effort to assess accuracy of data, superlattices in Ni base and Ti-Zr alloys, effect of lattice defects on heat capacity of Al

TEXAS CHRISTIAN UNIVERSITY

247. "Structural Studies of Amorphous Aluminum Oxide" — $20,319 — 02-02
R. F. Raeuchle - Department of Physics
diffuse x-ray scattering, radial distribution analysis, material studied is anodic Al_2O_3 and dehydration product of alumina trihydrate

TUSKEGEE INSTITUTE

248. "Density Determinations Using a Gamma Radiation Attenuation Technique" $42,000 01-01
I. G. Dillon - School of Engineering
alkali metals, coexisting vapor-liquid phases, 2 K curie Cs-137 source, temperatures up to 2500°K

UTAH, UNIVERSITY OF

249. "Recrystallization and Sintering of Oxides" $14,900 01-01
I. B. Cutler - Dept. of Ceramic Engineering
quantifying shrinkage during sintering, powder characterization, effects of impurities on diffusion, Al_2O_3 MgO CaO, glass-effect of MnO TiO_2 H_2O

250. "A Magnetic Resonance Study of Defects in Solids" $29,928 02-02
W. D. Ohlsen - Department of Physics
quadrupole shifted NMR lines in mixed alkali halides, LiF NaF

251. "Interstitial Diffusion in Non-Metallic Crystals" $21,000 01-02
O. W. Johnson - Department of Physics
interstitial diffusion point defects and complexes in TiO_2, Li diffusion, effects of pressure, electrical properties, infrared absorption spectra

252. "Radiation Damage in Nb and Ta" $30,385 02-03
J. W. DeFord - Department of Physics
electrical resistivity, electron irradiation, damage and annealing

253. "Impurity Effects on the Creep of Polycrystalline Magnesium and Aluminum Oxides at Elevated Temperatures" $18,262 01-01
R. S. Gordon - Department of Ceramic Engineering
creep up to 1300°C, four point loading, dense MgO doped with Fe_2O_3, effect of impurities and porosity on creep, grain growth, Al_2O_3

254. "The Fundamentals of Radiation Damage" $76,283 02-03
A. Sosin - Department of Physics
electron irradiation up to 8 MeV energy, damage rate as a function of energy, annealing

VANDERBILT UNIVERSITY

255. "Deformation Studies of Superlattice Structure" — $29,000 — 01-02
J. J. Wert and S. G. Cupschalk - Dept. of Mechanical Engineering
x-ray diffraction, electron microscopy, Cu_3Pt Cu_3Au

VERMONT, UNIVERSITY OF

256. "Absorption of Hydrogen and Deuterium by Palladium-Rich Alloys" — $23,021 — 01-02
T. B. Flanagan - Department of Chemistry
diffusion, electrochemical relaxation method, Pd-Ni, Pd-Ir, Pd-V

VIRGINIA, UNIVERSITY OF

257. "Electronic Properties of Metals and Alloys" — $68,000 — 02-02
R. V. Coleman - Department of Physics
conductivity, magnetoresistance, Hall effect, electron tunneling, magnetostriction, NMR, ferromagnetic alloys, spin wave scattering of electrons, Fe Ni Co

258. "Investigations on the Behavior of Point Defects and Dislocations" — $62,806 — 02-02
D. Kuhlmann-Wilsdorf - Department of Engineering Physics
work hardening, fatigue, voids in metals, perfection in Cu single crystals, theory of melting

259. "Electron Diffraction Studies of Single Crystal Metal Surfaces" — $24,203 — 01-01
K. R. Lawless - Department of Materials Science
LEED, HEED, early stages of oxidation, clean single crystal surfaces, Auger spectroscopy, Cu

260. "Dynamic Dislocation Phenomena in Single Crystals of Metals and Alloys" — $58,000 — 02-02
J. W. Mitchell - Department of Physics
growing Cu-Al high perfection crystals, second and third order elastic constants, elastic and plastic phenomena near yield point, dislocation velocity and resistivity

WAKE FOREST COLLEGE

261. "A Study of Atomic Mobility in Crystalline Materials" — $16,073 — 02-02
T. J. Turner and G. P. Williams - Dept. of Physics
internal friction, resistivity, Y Y-Ta Ag alloys, optical absorption, dielectric relaxation, NaF KCl MgO

WASHINGTON, UNIVERSITY OF

262. "A Study of Phase Transformations and Superconductivity" — $28,150 — 01-02
D. H. Polonis - Department of Metallurgical Engineering
microstructure related to superconducting properties, effect of solute concentration coherency strains precipitation, electron microscopy, titanium alloys, omega phase in Ti-Cr

263. "Mössbauer Studies at High Pressure" — $29,320 — 02-02
R. L. Ingalls - Department of Physics
internal magnetic field, isomer shift of transition metals, alloys and compounds containing Fe-57, pressure dependence

WAYNE STATE UNIVERSITY

264. "Electron Paramagnetic Resonance Studies of Radiation Effects in Solids and Chemical Compounds" — $55,000 — 02-03
Yeong-Wook Kim - Department of Physics
microwave spectroscopy, optical absorption, ENDOR, neutrons gammas, alkali halides,phosphors,superconducting films

265. "Investigation of the Atomic Structure and Nature of the Magnetism in Several Magnetic Glasses" — $25,239 — 02-02
H. O. Hooper - Department of Physics
structure and short range order in semiconducting glasses, NMR, EPR, bulk magnetization, conductivity

WISCONSIN, UNIVERSITY OF

266. "Creep Mechanisms in B.C.C. Alloy Crystals" $27,273 01-01
R. A. Dodd and P. R. Strutt - Department of Minerals and Metals Engineering
creep, electron microscopy, NiAl as a function of stoichiometric composition, CoAl CuZn

267. "The Effect of Surface Tension on the Sintering Rate of Metal Alloys" $12,264 01-01
J. S. Hirschhorn - Department of Minerals and Metals Engineering
dilatometric studies ofsintering kinetics, surface tension effects, Cu Cu-Sb

YALE UNIVERSITY

268. "X-Ray Study of the Structure of Liquid Metals and Alloys" $23,353 01-02
C. N. J. Wagner - Department of Engineering and Applied Science
atomic distributions in liquids and temperature dependence, Zn Cd Cu_3Sn Ag_3Sn In Tl Sn, electron transport properties, Ag-Sn, Au-Sn Cu-Sn Hg-Tl Hg-In

269. "The Study of Ideal Magnetic Crystals" $112,500 02-02
W. P. Wolf - Department of Physics and Engineering and Applied Science
magnetothermal measurements, neutron scattering, rf relaxation, ESR, NMR, theory and experiments, magnetic materials, rare earth compounds, $CeCl_3$ $Dy_3Al_5O_{12}$

SECTION C

Index of Investigators,
Materials, Phenomena,
Technique and Environment

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

INVESTIGATORS

MATERIALS

Actinide Metals and Compounds

2	22	118
3	23	128
17	32	188
19	95	223

Ceramics

Carbides	Glass	Nitrides
19	58	91
59	74	92
71	78	101
81	129	102
137	185	221
167	249	
185	265	

Oxides				
19	78	104	171	228
21	86	105	173	229
30	90	109	179	247
33	92	111	185	249
35	95	134	206	251
50	99	144	216	253
54	102	146	221	

Other
32
38
74
78
90
148
185
199

Graphite

35	
99	
173	
183	
220	

Intermetallic Compounds

3	27	77	163
12	45	85	204
14	55	97	222
15	60	128	225
16	63	137	245
23	75	140	255
			266

Ionic Crystals

Alkali Halides			
26	109	164	223
28	111	171	231
33	141	172	238
49	150	203	250
67	152	207	261
104	153	208	264
105	158	209	
106	162	217	

Other	
14	188
53	205
69	224
113	229
148	241
149	
174	
175	

Liquids

4	103		
23	127		
27	157		
33	193		
34	219		
40	248		
70	268		

Metals

Alkali	BCC			Ferrous	
11	5	92	154	21	119
68	6	93	156	22	130
70	21	94	159	25	131
106	25	96	163	31	132
122	37	97	168	37	139
127	39	98	182	53	142
153	52	102	187	60	161
193	55	104	190	66	169
232	56	107	192	73	177
248	57	119	214	75	196
	65	122	226	76	215
	75	142	230	77	257
	76	143	240	97	263
	77	147	246	110	
			252		

Organics

48			
66			
76			
88			
121			
239			

Rare Earth Metals and Compounds

3	13	93	195
4	15	106	222
6	16	110	225
7	21	133	269
8	22	134	
9	30	180	
10	32	188	

Semiconductors

11	104	176
12	106	178
35	108	200
37	109	219
58	135	227
72		238
79		265

Solid and Liquid Inert Gases

Helium		Other
11	43	27
15	68	43
29	126	69
31	136	189
34	160	
	195	

TECHNIQUE

Elastic Constants

3
21
59
67
69
115
141
153
209
222
223
226
260

Electrical Resistance

6
10
12
13
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227
228
241
245
252
257
261
268

Electron Microscopy

18
25
39
62
64
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93
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112
118
119
130
131
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141
154
155
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166
186
191
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197
212
220
234
236
255
262
266

Electron Scattering

5
18
77
131
141
143
155
168
196
197
202
240
244
259

Electron Spin Resonance

9
28
31
33
49
70
85
105
109
129
133
148
150
175
180
238
264
265
269

Field Ion Microscopy

59
77
79
143
147
159
167

High Temperature Heat Capacity

3
16
80
92
246

Infrared Spectroscopy

28
86
151
251

Internal Friction

19
20
52
57
142
146
152
220
226
230
239
261

Laser Beam Scattering

16
69
86
87
174

Low Temperature Specific Heat

10
11
22
29
30
36
55
80
91
101
111
126
136
138
172
225

Magnetic Susceptibility

16
22
55
68
85
101
126
169
199
222
224

Mössbauer Effect

9
19
22
32
65
66
122
124
131
139
199
225
229
263

Neutron Scattering

10
15
23
27
42
43
44
45
54
106
110
120
169
184
199
237
269

Nuclear Magnetic Resonance

9
22
24
31
63
70
85
129
133
136
175
188
195
250
257
269

Optical Absorption

14
16
28
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66
87
103
105
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121
129
133
135
144
148
150
158
164
171
203
208
210
217
227
245
261
264

Stress-Strain

1	57	95	166	194	253
2	61	118	173	196	255
6	73	119	177	206	258
20	74	130	181	214	260
21	75	132	182	218	266
25	76	142	185	234	
38	78	153	186	242	
39	94	161	190	243	

Theory

8	84	195
17	100	226
34	113	231
47	149	233
53	157	245
75	160	258

Thermal Conductivity

10	111
12	131
30	136
68	151
71	172
91	
92	

Thermodynamics

3	80	128	201	246
11	82	147	204	248
22	89	179	216	249
29	96	185	220	253
31	97	189	221	256
56	111	190	224	267
65	122	192	228	
78	127	197	241	

X-Ray Scattering

31	72	108	140	210
50	79	114	152	222
56	96	119	163	225
60	97	131	191	227
66	98	132	193	230
69	99	138	194	247
				255
				268

PHENOMENA OR TOPIC

Channeling

53
112
113
116
145
159

Crystal Structure and Atomic Distribution

23	128	193
27	131	221
54	138	222
60	139	225
118	147	247
120	163	265
127	185	268

Diffusion

4	63	91	128	193	232	251
5	68	95	139	205	235	256
21	71	98	153	207	241	261
40	74	102	159	216	242	
57	78	122	185	228	249	

Dislocations

1	75	114	159	243
20	77	115	190	258
57	79	130	191	260
61	96	132	214	
62	108	154	218	

Electron Transport

12	40	141	210	257
13	64	176	216	265
19	101	178	219	268
30	121	183	227	
32	131	200	228	
36	134	204	241	

Electronic Structure

Fermi Surface	Other			
8	17	55	113	219
32	19	63	138	222
36	24	70	139	225
68	34	84	149	233
100	45	91	188	245
180	53	101	199	

Ferromagnetism

13
22
45
47
85
106
120
125
131
172
175
180

Magnetic Structure

13
15
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110
113
120
134
155
169
184
188
195
224
225
229
263
269

Materials Preparation and Characterization

7
26
46
90
104

Phonons

12
15
27
29
30
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43
69
111
113
133
136
151
160
174
189
223
237

Point Defects

6
17
21
25
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231
238
241
251
252
254
258
264

Precipitation

21	77	99	230
56	81	140	234
60	93	143	244
63	94	177	259
65	96	197	262

Sintering

74	236
95	249
165	267
185	

Strength

Fracture		Super-plasticity	Creep		Other		
21	161	2	38	153	1	75	177
74	173	64	39	242	2	79	181
76	186	118	57	243	6	91	182
94	206	242	91	253	20	95	190
130	234		95	266	25	118	194
					57	119	214
					71	142	255
					73	166	258
							260

Superconductivity

10	83	117	170
30	84	131	195
36	88	136	211
41	93	137	262
51	101	151	264
81	107	154	

Superlattices

1
31
65
99
191
245
246

Surface Phenomena and Thin Films

5	64	102	143	170	202	244
18	71	112	144	171	206	259
41	78	114	156	185	210	
51	96	116	165	189	218	
59	98	118	168	196	220	
61	99	141	169	197	240	

Twinning

1
21
79
96
163

ENVIRONMENT OR EXTERNAL VARIABLE

Electric Field

4
19
40
71
135
232

Gas

Oxidizing	Other
18	161
61	168
98	218
144	220
179	228
216	240
259	

Liquid

Liquid Metal	Other
156	33
	61
	114
	161
	218

Magnetic Field

High Field		Low Field			
13	101	8	32	111	158
16	154	9	36	117	175
41	178	19	42	129	180
81	224	22	70	131	187
	269	24	85	133	188
		30	93	134	200
		31	107	150	215
					262

Pressure

Above Atmospheric				Shock Loading
11	66	134	223	75
19	67	141	235	76
27	68	153	239	79
43	69	183	251	243
45	100	188	263	
54	122	209		

Radiation

Electron	Ion	Neutron	Proton	Theory	Various & Other	
37	25	6	226	53	28	164
52	72	25	212	113	35	172
72	112	99		149	48	176
112	116	107		231	49	203
145	159	108			50	205
213	202	114			109	208
214	212	117			121	264
227	230	119			129	
239		182			148	
252		198			162	
254		200				
		220				

Temperature Below Liquid Helium		High Temperature (about 1000°K or higher)		
10	111	12	122	222
11	117	39	128	228
29	126	57	177	232
30	136	78	186	234
31	151	80	192	242
41	152	82	193	243
51	170	90	204	246
86	195	92	206	248
88	224	94	216	249
101	225	95	217	253
		98	220	266
		102	221	268
		119		

SECTION D

Summary of Funding Levels

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

Summary Table

During the fiscal year ending June 30, 1968, the Metallurgy and Materials Programs total support level amounted to about $27 million in operating funds and $1.9 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 $27 million operating funds.

1. By Region of the Country:

	University Program (%)	Total Program (%)
(a) Northeast (N.Y., Mass., Vt., Maine, Conn., R.I., Penn., N.J., Md., Del.)	48.5	21.5
(b) South (Va., Ky., Tenn., N.C., S.C., Ga., Fla., Ala., Miss., La.)	12.0	22.5
(c) Midwest. (Ohio, Ind., Mich., Ill., Wisc., Minn., Iowa, Mo., Kansas, Nebraska, N.D.)	21.7	41.0
(d) West (Texas, Okla., Ariz., Calif., Utah, Idaho, Oregon, Wash., Montana)	17.8	15.0

2. By Academic Department or Laboratory Division:

	University Program (%)	Total Program (%)
(a) Metallurgy, Materials Science, Ceramics, Other Engineering (Office Budget Activity Numbers 01-).	44.3	42.1
(b) Physics, Solid State Science, Solid State Physics (Office Budget Activity Numbers 02-).	55.7	57.9

SUMMARY OF
FUNDING LEVELS

3. By AEC Laboratory and University:

	Total Program (%)
(a) University Program (including those laboratories where graduate students are involved in research to a large extent -- e.g., Ames Laboratory and Lawrence Radiation Laboratory-Berkeley).	48.1
(b) AEC Laboratory Program (including laboratories where there is very little graduate student involvement -- e.g., Atomics International).	51.9

4. By Laboratory:

	Total Program (%)
Ames Laboratory	9.1
Argonne National Laboratory	20.2
Atomics International	1.8
Brookhaven National Laboratory	9.6
Idaho Nuclear Corporation	0.5
Lawrence Radiation Laboratory/Berkeley	6.6
Oak Ridge National Laboratory	18.4
Pacific Northwest Laboratory	1.5
Puerto Rico Nuclear Center	0.9
University of Illinois Materials Research Laboratory	5.7

SUMMARY OF
FUNDING LEVELS

5. By Area of Research:

	Number of Projects (Total=269) (%)		Total Program $ (%)	
(a) Materials				
Actinide Metals and Compounds	4.5	6.8	3.6	4.2
Ceramics	20.0	15.7	8.1	10.0
Oxides	12.6		4.6	
(In "Ceramics" Departments)	6.0		4.1	
Alkali Halides	11.5		4.9	
BCC Metals	15.6		7.4	
Rare Earth Metals and Compounds	9.3	7.5	6.0	5.4
Semiconductors	7.1		3.0	
Inert Gas Solids and Liquids	5.6	4.6	3.9	3.3
(b) Technique				
ESR and NMR	10.4		7.0	
Mössbauer	5.2		1.5	
Neutron Scattering	6.3	6.1	12.9	13.1
Theory	6.7	8.6	6.9	6.6
Thermal Conductivity	4.5		2.3	
(c) Phenomena				
Diffusion	12.2	12.2	5.3	4.0
Strength	17.0	17.5	10.3	10.0
Superconductivity	8.6	7.5	6.3	7.0
Surface Phenomena and Thin Films	14.1	10.7	7.0	6.5
(d) Environment				
High Pressure	8.5	7.9	4.6	4.1
Radiation	18.6	13.9	16.9	15.8
Below Liquid Helium Temperature	7.4		7.7	

FY 1968 Funding Levels

	Projects (Total-269) Number	%	Funding (Total-27M$) K$	%
MATERIALS				
			1153	4.2
Actinide Metals and Compounds	12	4.5	982	3.6
			2787	10.0
Ceramics - Total	54	20.0	2,179	8.1
In "Ceramics" Depts.	16	6.0	1,110	4.1
Carbides	7	2.6	275	1.0
Glass	7	2.6	271	1.0
Nitrides	5	1.9	128	0.5
Oxides	34	12.6	1,239	4.6
Other	8	3.0	266	1.0
Ionic Compounds				
Alkali Halides	31	11.5	1,330	4.9
Metals				
FCC	42	15.6	2,020	7.4
			1497	5.4
Rare Earth Metals and Compounds	25	9.3	1,611	6.0
Semiconductors	19	7.1	813	3.0
			926	3.3
Solid and Liquid Inert Gases	15	5.6	1,062	3.9
TECHNIQUE				
Electron Spin Resonance and Nuclear Magnetic Resonance	28	10.4	1,882	7.0
Mossbauer Effect	14	5.2	414	1.5
			3636	13.1
Neutron Scattering	17	6.3	3,494	12.9
			1843	6.6
Theory	18	6.7	1,858	6.9
Thermal Conductivity	12	4.5	632	2.3

	Projects (Total-269) Number	%	Funding (Total-27M$) K$	%
PHENOMENA OR TOPIC				
Diffusion	33	12.2	1105 1,433	4.0 5.3
Strength - Total	46	17.0	2764 2,787	10.0 10.3
Fracture	10	3.7	560	2.1
Superplasticity	4	0.1	127	0.5
Creep	10	3.7	329	1.2
Other	23	8.5	1,771	6.6
Superconductivity	23	8.6	1930 1,700	7.0 6.3
Surface Phenomena and Thin Films	38	14.1	1806 1,893	6.5 7.0
ENVIRONMENT OR EXTERNAL VARIABLE				
Pressure, Above Atmospheric	23	8.5	1154 1,234	4.1 4.6
Radiation	50	18.6	4374 4,562	15.8 16.9
Temperature Below Liquid Helium	20	7.4	2,085	7.7