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FINAL TECHNICAL REPORT, AEC AT (11-1) - 535
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STUDIES OF IMPERFECTIONS IN SOLIDS

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June, 1970

MASTER

I. PROGRESS SINCE THE LAST TECHNICAL REPORT

(February, 1968)

Work under this contract since February 1968 is described in the following attached documents:

1. Thermal Diffuse X-Ray Scattering Measurements of the Fermi Surface of Chromium, by James Costello and John Weymouth, Phys. Rev. 184, 694 (1969). (C00-525-28)
2. Simultaneous Production and Bleaching of F Centers in KCl, by Dennis Covault and Edgar Pearlstein, Phys. Rev. 166, 906 (1968). (C00-525-26)
3. Stored Energy in Irradiated Sodium Chloride, by James Bunch and Edgar Pearlstein, Phys. Rev. 181, 1290 (1969) (C00-525-27)
4. Continuous Averaging of X-Ray Diffraction Data Using a Multichannel Analyzer, by John Weymouth, James Costello, Sanford Schuster, and Paul Schulze. Rev. Scien. Instr. 39, 476 (1968). (C00-525-31)
5. Elimination of Harmonic Radiation in Thermal Diffuse X-Ray Scattering Measurements, by James Costello and John Weymouth, Acta Cryst. A24, 476 (1968) (C00-525-29)

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6. A Study of Thermal Diffuse X-Ray Scattering from Lead, by Sanford Schuster. Ph.D. Thesis, University of Nebraska 1969. (C00-525-32)
7. Coloration of $KCl:OH^-$ by Ultraviolet Light, by Wendell Bradley. Ph.D. Thesis, University of Nebraska 1970. (C00-525-33)
8. A Thermal Diffuse X-Ray Scattering Investigation of the Lattice Dynamics of Caesium, by John Eldridge. Page proofs attached. (C00-525-34)

II. RESEARCH AREAS SUPPORTED BY THIS CONTRACT

Listed below is a summary of the subjects for research done on this contract.

1. Radiation effects: Dependence of radiation damage upon the energy of protons causing the damage.
2. Color centers in alkali halides: Stored energy. Kinetics of color center formation and bleaching. Dependence upon impurities.
3. Ionic conductivity in alkali halides: Nonlinearity of current-voltage relationship. Effects of impurities. Effect of seed-crystal preparation.
4. Defect concentrations: Vacancies in sodium metal. Screw dislocations in NaCl platelets.
5. Fermi surface studies: Kohn anomaly and the Néel point in chromium.
6. Lattice vibrations: Multiphonon effects in thermal diffuse scattering of x rays from lead. Elastic constants of chromium in the neighborhood of the Néel point.

III. PH.D. AND M.S. THESES SUPPORTED IN PART BY THIS CONTRACT

1. The Effects of Dislocations on the Ionic Conductivity of Sodium Chloride Crystals. Allan Blocher, M.S. 1958.

2. Stationary Dislocations in Sodium Chloride as Possible Vehicles for the Electrical Conductivity Mechanism, Wendell Bradley, M.S. 1960.
3. A Calorimetric Measurement of the X-Ray Produced Stored Energy in Sodium Chloride. Fred T. Phelps, Ph.D. 1961.
4. The Nonlinearity in the Electrical Conductivity of Sodium Chloride. Charles F. Skov, Ph.D. 1963.
5. Equilibrium Concentration of Point Defects in Sodium Metal. George A. Sullivan, Ph.D. 1964.
6. The Energy Dependence of Radiation Damage Induced in Copper by Low Energy H^1 and He^4 Ions. Bruce E. Anspaugh, Ph.D. 1964.
7. Correlation Between Conductivity and X-Ray Colorability in Pure and Doped KCl. Tauba Anderson, M.S. 1964.
8. Simultaneous Production and Bleaching of F Centers. Dennis O. Covault, Ph.D. 1966.
9. Thermal Diffuse X-Ray Scattering and the Fermi Surface in Antiferromagnetic Chromium. James M. Costello, Ph.D. 1967.
10. Stored Energy in Irradiated Sodium Chloride. James M. Bunch, Ph.D. 1967.
11. A Study of Thermal Diffuse X-Ray Scattering from Lead. Sanford L. Schuster, Ph.D. 1969.
12. Coloration of $KCl:OH^-$ by Ultraviolet Light. Wendell G. Bradley, Ph.D. 1970.

IV. PUBLICATIONS SUPPORTED BY THIS CONTRACT

1. Radiation Effect in Copper Irradiated with 50-350 keV Protons at 115°K by E. Pearlstein and B. Anspaugh, Bull. Am. Phys. Soc. 4, 135 (1959).
2. Measurement of Stored Energy in X-Irradiated Sodium Chloride by F. Phelps and E. Pearlstein, Bull. Am. Phys. Soc. 5, 185 (1960).

3. Stored Energy in X-Irradiated Sodium Chloride, by F. Phelps and E. Pearlstein, Bull. Am. Phys. Soc. 6, 114 (1961).
4. New Bridge Circuit for Comparing Four-Terminal Resistors, by E. Pearlstein, Rev. Sci. Instr. 33, 610 (1962).
5. Measurements of the Stored Energy in X-Rayed Sodium Chloride, by F. Phelps and E. Pearlstein, Phys. Rev. 128, 1575 (1962).
6. Nonlinear Ionic Conduction in Alkali Halide Crystals, by C. Skov and E. Pearlstein, Bull. Am. Phys. Soc. 8, 268 (1963).
7. Dynamical Theory of Atom Jumps in Crystals, by E. Pearlstein, Am. Journ. Phys. 31, 842 (1963).
8. Concentration of Point Defects in Sodium Metal, by G. Sullivan and J. Weymouth, Bull. Am. Phys. Soc. 9, 110 (1964).
9. Sensitive Method for the Measurement of Nonlinearity of Electrical Conduction, by C. Skov and E. Pearlstein, Rev. Sci. Instr. 35, 962 (1964).
10. Equilibrium Concentration of Point Defects in Sodium Metal, by G. Sullivan and J. Weymouth, Phys. Letters 9, 89 (1964).
11. Statistical Tables for Testing Random Orientations of Cubic Crystals, II, by J. Weymouth and J. H. Epstein, Jour. Appl. Phys. 35, 3008 (1964).
12. Measurement of the Equilibrium Net Vacancy Concentration in Sodium, by G. Sullivan and J. Weymouth. Phys. Rev. 136, A1141 (1964).
13. Nonlinear Ionic Conductivity in Alkali Halide Crystals, by C. Skov and E. Pearlstein, Phys. Rev. 137, A1483 (1965).
14. Effect of Simultaneous Bleaching and X-Ray Irradiation on Coloration in KCl, by D. Covault and E. Pearlstein, Bull. Am. Phys. Soc. 10, 373 (1965).

15. Effect of Simultaneous Bleaching and X-Ray Irradiation on Coloration in KCl, by D. Covault and E. Pearlstein, Bull. Am. Phys. Soc. 11, 364 (1966).
16. Contamination of KCl Crystals by Some Common Metals, by J. Penley, Jour. Chem. Phys. 45, 756 (1966).
17. Thermal Diffuse X-Ray Scattering from Paramagnetic and Antiferromagnetic Chromium, by J. Costello and J. Weymouth, Bull. Am. Phys. Soc. 12, 286 (1967).
18. Ionic Conductivity of KOH-Doped KCl Pellets, by J. Penley, Jour. Appl. Phys. 38, 1978 (1967).
19. Simultaneous Production and Bleaching of F Centers in KCl, by D. Covault and E. Pearlstein, Phys. Rev. 166, 906 (1968).
20. Continuous Averaging of X-Ray Diffraction Data Using a Multichannel Analyzer, by J. Weymouth, J. Costello, S. Schuster, and P. Schulze, Rev. Sci. Instr. 39, 476 (1968).
21. Elimination of Harmonic Radiation in Thermal Diffuse X-Ray Scattering Measurements, by J. Costello and J. Weymouth, Acta Cryst. A24, 476 (1968).
22. Thermal Diffuse X-Ray Scattering Measurement of the Fermi Surface of Chromium, by J. Costello and J. Weymouth, Phys. Rev. 184, 694 (1969).
23. Stored Energy in Irradiated Sodium Chloride, by J. Bunch and E. Pearlstein, Phys. Rev. 181, 1290 (1969).
24. An Experimental and Theoretical Comparison of Thermal Diffuse X-Ray Scattering from Pb, by S. Schuster and J. Weymouth. Collected Abstracts of Int. Union of Cryst. International Conference, in Acta Cryst. A25, Suppl. (1969).

25. A Thermal Diffuse X-Ray Scattering Investigation of the Lattice Dynamics of Caesium Iodide, by J. Eldridge, Jour. Phys. C, (in press).

June 11, 1970