The important issue of how the superconducting transition temperature $T_c$ in disordered systems changes near the N-I transition where strong localization ($x^{-1} \ll 1$) is expected has been studied in the No-Ge system. In the high No concentration, which is in the weakly localized regime, $T_c$ decreases linearly with increasing No concentration from 7.56K ($\approx$ at 5% No) at a rate of $0.18^\circ$ K/atom of No. In this region the ratio of electron-phonon coupling constant $\lambda$ to the bare density of states $V(0)$ is constant, which is consistent with the Varma-Dynes tight-binding model. An extrapolation of the linear behavior of $T_c$ in this regime yields the disappearance of $T_c$ near 33 at 6% No. However, measurements show that $T_c$ exists down to 13.5 at 6% No. A non-superconducting metallic phase is found to exist between 13.5 at 10.4 at 6% No at which concentration the insulating phase occurs. 

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Superconductivity in very thin films of niobium has been investigated. By use of the ion gun which has been installed in the evaporator it has been possible to identify 3 separate mechanisms which contribute to the reduction in $T_C$ as the film thickness is decreased, namely lifetime broadening, proximity effect and localization. Then upon elimination of the first two, the effect of localization in the weakly localized limit is found to agree quantitatively with theory except for $< 15\AA$ where the fall off of $T_C$ is less than expected.

A small single grid ion source has been constructed in order to promote the growth of metastable films at low temperatures. A high flux of N$_2$ at energies as low as 20 eV has been achieved. Studies indicate that the ion beam promotes the growth of single crystal A15 compounds at lower temperatures. Preliminary studies on the growth of transistor metal nitrides have been initiated.

Progress has been made on a new ultra high vacuum M.B.E. evaporator being constructed at Stanford with funds from the DOD Instrumentation Program. A vendor has been selected and a purchase order made for the design-study of the load-lock/transfer arm and substrate configuration. This is the most sensitive and critical part of our unique concept of load-locking and transferring the complete substrate configuration into and out of the evaporation chamber. Sputtering of molybdenum disulfide onto the disassembled parts - balls, races, and retainers has been chosen as the first step in improving the reliability of the ball bearings used in the present method of evaporation rate control.
INTERIM TECHNICAL REPORT
FOR
AIR FORCE OFFICE OF SCIENTIFIC RESEARCH
Contract No. F49620-82-C-0014
1 October 1984 - 31 March 1985

SUPERCONDUCTING THIN FILMS, COMPOSITES AND JUNCTIONS

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5. "Specific Heat of Thin Film Amorphous Molybdenum Based Alloys," by D. Mael, W. L. Carter, S. Yoshizumi and T. H. Geballe, accepted to Phys. Rev. B.


Visitors and Seminars

1. D. McWhan, AT&T Bell Labs, January 15, 1985
3. P. W. Anderson, Princeton University, February 8, 1985
4. S. Schultz, University of California, San Diego, February 21-22, 1985
5. P. Grant, IBM Research, San Jose, February 25, 1985
8. J. Krim, University of Marseille, "Wetting and Non-Wetting of Rare Gases on Au and Graphite: Recent Results" February 21, 1985
9. J. Talvacchio, Westinghouse Research Labos "Recent Thin-Film Research at Westinghouse" April 26, 1985
Interim Technical Report - AFOSR Contract No. F49620-C-0014
Period: 1 October 1984 - 31 March 1985 (PI: T. H. Geballe)

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Member, Editorial Board of Chinese Physics, AIP

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Member, Committee for the American Physical Society International Prize for New Materials

Member, Advisory Board of the Miller Institute for Basic Research in Science

Member, Program Committee for meeting on "Materials and Mechanisms of Superconductivity" in Ames, Iowa 5/29-31/85

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New discoveries, inventions or patent disclosures

NONE
Persons working on contract during the period
1 October 1984 - 31 March 1985

Hammond, Robert H.          Senior Research Associate
Hellman, Frances            Ph.D. expected Summer 1985
Mael, David                 Ph.D. expected Summer 1986
Broussard, Phillip          Ph.D. expected Summer 1986
Park, Sung                  Ph.D. expected Summer 1986
Kent, Andrew                Ph.D. expected Summer 1987
Ch., Byungdu                Ph.D. expected Summer 1987