

AD-A259 089



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Form Approved
OMB No. 0704-0188

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REPORT DATE
10-28-92

3. REPORT TYPE AND DATES COVERED
FINAL

4. TITLE AND SUBTITLE
Advanced UHV Thin-Film Deposition Facility for Research in Superconductivity and Superconducting Electronics

5. FUNDING NUMBERS
N00014-84-G-0170
N00014-84-J-1170

6. AUTHOR(S)
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7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
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Office of Naval Research
800 N. Quincy Street
Arlington, VA 22217-5000

10. SPONSORING/MONITORING

92-31401



478

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT
unlimited

DISTRIBUTION STATEMENT A
Approved for public release
Distribution Unlimited

12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)

The final report for the above grant describes an "Advanced UHV Thin-Film Deposition Facility for Research in Superconductivity and Superconducting Electronics." A list of acquired equipment and a discussion of special circumstances regarding changes from the proposal and use of the equipment also follows. The completed facility is in full use for research as described in the proposal, and in high Tc superconducting materials research, other oxide materials, and C₆₀ Fullerene alloys. A new vapor synthesis process monitor and control techniques (Atomic Absorption Rate Control) has been developed.

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14. SUBJECT TERMS
Thin film, superconductivity

15. NUMBER OF PAGES
3
16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT
unclassified

18. SECURITY CLASSIFICATION OF THIS PAGE
unclassified

19. SECURITY CLASSIFICATION OF ABSTRACT
unclassified

20. LIMITATION OF ABSTRACT
unlimited

Final Report ONR Grant N00014-84-J-1170 (formerly N00014-84-G-0170)
Title: Superconductivity and Superconducting Electronics Research
Principal Investigator: Professor M. R. Beasley

The following is a final report for the above grant. It includes a list of acquired equipment (by name, manufacturer, and cost), and discusses special circumstances regarding changes from the proposal, and the use of the equipment both as it relates to the work described in the proposal, and as it relates to other research of interest to the Department of Defense.

The name of the equipment in the proposal was "Advanced UHV Thin-Film Deposition Facility for Research in Superconductivity and Superconducting Electronics." During the design-stage for this equipment several circumstances resulted in delays and changes in the design. The original proposal was based on the major vendor being Thermionics Laboratory, Inc. However, when the time came to start work the two key people that would have been the major contributors were not available (due to one leaving the company, and the other to a serious illness and operation). After a new search for a single vendor to carry out the design and construction failed to locate one, the detailed design was initiated by a member of our research group with help from outside draftsmen.

The second circumstance also delayed, and altered the design and final use of the facility. This was the discovery of the High Temperature Superconductors, the copper oxide based materials. This introduced drastic changes in how the equipment was designed and fabricated, and, finally in its use. The immediate impact was on the time of the designer of the facility. The frenzied activity during the year 1987 through the present, but mostly the first three years resulted in delays in the design and implementation of the facility. The need to shift some of the design load onto outside vendors resulted in a shift in the proposed spending. The needs of the new materials necessitated some important changes, and, indeed inventions. Development of evaporation rate monitoring techniques that can function in the presence of a high background pressure of oxygen, and the development and understanding of methods to provide activated oxygen to the growth region of the thin films were two of the changes. These also result in necessitated changes in the spending from that in the proposal.

The completed facility is in full use for research as described in the proposal, and, of course, in high Tc superconducting materials research. With respect to other changes from the proposal as it relates to other research of interest to the Department of Defense, in addition to the area of High Tc Superconductivity, we are researching the synthesis of other materials including other oxide materials, and C60 Fullerene alloys. We also note that in the process of this work we have developed a new vapor synthesis process monitor and control techniques (Atomic Absorption Rate Control), and the generation and monitoring of activated oxygen, and further similar activities are in progress. We expect these activities will find use to other Department of Defense programs.

The equipment is listed in the following. The majority of the construction was by R. J. Munns Mfg., Inc., who also assembled much of the system.

**EQUIPMENT LIST FOR N00014-84-J-1170
(Formerly N00014-84-G-0170)**

1. VAPOR DEPOSITION SYSTEM

R J MORNS MFG	DEPOSITION SOURCE ASSEMBLY	\$ 75,542
R J MORNS MFG	RJ MORNS ENG & DESIGN SERVICES/MBS	14,180
ELECTRONIC TRANSFORM	PROTOTYPE ETS X-Y SWEEP GENERATOR	5,377
NICK HUMBY CO	TEMP CONTROL/NSIC 1771 28840	1,797
PROTEUS INDUSTRIES	FLOW SWITCHES	1,597
ETB INC.	ELECTRON BEAM SOURCE	3,825
	VALVES/NUTS/BELLOWS/TUBING/ETC	3,680

105,998

2. LOAD-LOCK PROCESSING CHAMBER

R J MORNS MFG	SUBSTRATE ARM SUPPORT/QUARTS MONITOR	24,636
R J MORNS MFG	GLOVE BOX AND CART	30,005
R J MORNS MFG	ASSEMBLY OF TRANSFER-SUBSTRATE ARM INNER AND OUTER SEALS/DESIGNS FOR GENERAL ASSEMBLIES	49,220
NELSON BOWER	LOAD LOCK PROCESS CHAMBER PHASE II	7,000
LEHIGH DESIGN	LOAD-LOCK PROC CHAMBER	1,502
GRANVILLE PHILLIPS	ASSORTED	1,986
R J MORNS MFG	SAPPHIRE WINDOW/WIPPLE/VALVE	6,003
BEARING ENGINEERING	BEARINGS	4,365
BARNARD AND ASSOC.	BENDIX FLEXURAL PIVOT PART	1,167
	SENSORS/BEARINGS/BEAMS SPLITTER/ETC	2,883

128,767

3. UVV VACUUM SYSTEM

R J MORNS MFG	UVV VACUUM SYSTEM	25,327
R J MORNS MFG	UVV VACUUM SYSTEM AND CONTROLS	98,887
VARIAN VACUUM	CRYOPUMP	15,649
"	CRYOPUMP	11,182
R J MORNS MFG	ALCATEL PUMP	6,201
R J MORNS MFG	VIEWPOINT WINDOWS, HEATER, ETC	4,349
VARIAN VACUUM	REMOTE TEMP DIGITAL DISPLAY	1,338
"	VALVES AND HOSE	1,631
LEHIGH DESIGN	UVV VACUUM SYSTEM DESIGN	1,028
VARIAN VACUUM	STARCELL VACUUM PUMP	7,155
"	POWER UNIT FOR ABOVE	1,312
"	HIGH VOLTAGE CABLE/LOW PUMP METER	489

174,548

4. DEPOSITION RATE MONITOR/FEEDBACK CONTROL

LEYBOLD	RATE MONITOR	5,912
BAZERS	PUMP/DRIVE UNIT/SPLITTER SCREEN	3,316
ALCATEL VACUUM	ALCATEL MECHANICAL VACUUM PUMP	1,164
VARIAN VACUUM	STARCELL VACUUM PUMP	4,794
"	NON-EVAPORABLE GETTER	2,140
"	POWER UNIT	1,584
"	HEATER/CABLES	1,091
"	BEARINGS/RAILS/POSTS/LAMPS/ETC	1,460

21,461

5. IN SITU CHARACTERIZATION EQUIPMENT

MICROSCIENCE	NEED DIFFRACTION SYSTEM	25,101
VC INSTRUMENTS	SP300 QUADRUPOLE MASS SPECTROMETER	25,006
R J MORNS MFG		5,350

55,457

6. WILFISK

WILFISK PACKAGE: VACUUM CLEANER, EXHAUST FILTER, MICROFILTER, FLOOR BRUSH, 3" ROUND BRUSH, CREVICE NOZZLE	829
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7. VWR SCIENTIFIC

DEIONIZED WATER SUPPLY SYSTEM	777
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487,837

8. MISC SHIPPING CHARGES, ETC

663

\$488,500

9. STAMFORD UNIVERSITY COST SHARING

\$ 60,000

TOTAL COST OF PROGRAM

\$554,500

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