

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE

DOCUMENTATION PAGE

Form Approved OMB No. 0704-0188

AD-A212 120

TIC
EXC
308 1989
D

1b. RESTRICTIVE MARKINGS
NONE

FILE COPY

2b. DECLASSIFICATION / DOWNGRADING SCHEDULE
NONE

3. DISTRIBUTION / AVAILABILITY OF REPORT
UNLIMITED Approved for public release, distribution unlimited

4. PERFORMING ORGANIZATION REPORT NUMBER(S)
AFOSR/DELOZANNE-002

5. MONITORING ORGANIZATION REPORT NUMBER(S)
AFOSR-TR-89-1204

6a. NAME OF PERFORMING ORGANIZATION
UNIVERSITY OF TEXAS

6b. OFFICE SYMBOL (if applicable)

7a. NAME OF MONITORING ORGANIZATION
AFOSR/NE DR. H. WEINSTOCK

6c. ADDRESS (City, State, and ZIP Code)
DEPARTMENT OF PHYSICS
AUSTIN, TX 78712

7b. ADDRESS (City, State, and ZIP Code)
BUILDING 410
BOLLING AFB DC 20332-6448

8a. NAME OF FUNDING / SPONSORING ORGANIZATION
SAME AS 7

8b. OFFICE SYMBOL (if applicable)
NE

9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
AFOSR-89-0328

8c. ADDRESS (City, State, and ZIP Code)

Bld 410
Bolling AFB DC 20332-6448

10. SOURCE OF FUNDING NUMBERS

PROGRAM ELEMENT NO. 61102F	PROJECT NO. 2306	TASK NO. C1	WORK UNIT ACCESSION NO.
-------------------------------	---------------------	----------------	-------------------------

11. TITLE (Include Security Classification)
TUNNELING MICROSCOPY OF SUPERCONDUCTORS AND TUNNELING BARRIERS

12. PERSONAL AUTHOR(S) PROF. ALEX DE LOZANNE

13a. TYPE OF REPORT
FINAL

13b. TIME COVERED
FROM 6-1-88 TO 5-31-89

14. DATE OF REPORT (Year, Month, Day)
8-09-89

15. PAGE COUNT
3

16. SUPPLEMENTARY NOTATION

COSATI CODES		
FIELD	GROUP	SUB-GROUP

18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
HIGH TEMPERATURE SUPERCONDUCTIVITY
THIN FILMS, TUNNELING

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

At Westinghouse R. Silver built a cold stage for in-situ UPS measurements. Preliminary results show a fermi edge that disappears as the sample is warmed up in a vacuum. This surface degradation is reversible by annealing at 400C in pure oxygen.

The films made by co-evaporation at the U. of Texas have improved. Films on bare silicon have zero resistance by 73K. The best films grow on SrTiO3(110) with zero resistance by 84K and critical current densities greater than 10⁶A/cm² below 67K. These films have been characterized by in-situ low-temperature scan ; yielded, for the first time, good image ; mic measurements indicate thus far that mos few spots showing superconductive be

20. DISTRIBUTION / AVAILABILITY OF ABSTRACT
 UNCLASSIFIED/UNLIMITED SAME AS RPT DTIC USERS

21. SECURITY CLASSIFICATION
UNCLASSIFIED

UNCLASSIFIED

22a. NAME OF RESPONSIBLE INDIVIDUAL

DR HAROLD WEINSTOCK

22b. TELEPHONE (Include Area Code)

(302) 767-4937

22c. OFFICE SYMBOL

NE

ANNUAL REPORT
 GRANT # AFOSR-87-0228
 PI: Alex de Lozanne
 University of Texas at Austin

Program Manager: Dr. Harold Weinstock

SUMMARY

During this period we have concentrated on the characterization of YBCO films made by sputtering at Westinghouse and by co-evaporation at the University of Texas.

At Westinghouse R. Silver built a cold stage for in-situ UPS measurements. Great care was taken to prevent the loss of oxygen from the surface of the freshly made samples. Preliminary results show a fermi edge that disappears as the sample is warmed up in a vacuum. This surface degradation is reversible by annealing at 400C in pure oxygen. Details are given in publication (1) (copies attached).

The films made by co-evaporation at the U. of Texas have improved. Films on bare silicon have zero resistance by 73K. The best films grow on SrTiO₃(110) with zero resistance by 84K and critical current densities greater than 10⁶A/cm² below 67K. Details are given in publication (35) (copy attached).

At UT we have also implemented a unique system of loadlocks that allows us to transfer a film from the synthesis chamber to the low temperature STM for analysis. This has yielded, for the first time, good images of the YBCO surface. Spectroscopic measurements indicate thus far that most of the surface is normal, with a few spots showing superconducting behavior and a large superconducting gap. Details are given in publications 27,28,29,31,32 (copy attached).

PUBLICATIONS ACKNOWLEDGING SUPPORT FROM THIS GRANT

* = INVITED

- 1) "Preparation and Characterization of Superconducting Surfaces in HTS"
 G.R. Wagner, R.M. Silver, J. Talvacchio, J.R. Gavalier, and A.J. Panson, Proc. 2nd Workshop on High Temperature Superconducting Electron Devices, June 7-9, 1989, Hokkaido, Japan
- 22) "As-deposited Superconducting Y-Ba-Cu-O Thin Films on Si, Al₂O₃ and SrTiO₃ Substrates"
 R.M. Silver, A.B. Berezin, M. Wendman and A.L. de Lozanne, Appl. Phys. Lett., **52**, 2174 (1988).

- 25) "Properties of In-situ Superconducting Thin Films of Y-Ba-Cu-O on Si, Al₂O₃, and SrTiO₃ Substrates"
R.M. Silver, A.B. Berezin, E. Ogawa, and A.L. de Lozanne
Proceedings, Applied Superconductivity Conf., Aug. 1984, San Francisco, CA. IEEE Trans. Magn. **MAG-25**, 2526 (1989).
- *27) "Properties of Y-Ba-Cu-O Thin Films Grown In-Situ at Low Temperatures by Co-Evaporation and Plasma Oxidation"
A.L. de Lozanne, E. Ogawa, R.M. Silver, A.B. Berezin, and S. Pan, Proc. Conf. Science and Technol. of Thin Film Supercond., Nov 14-18, 1988, Colorado Springs, CO. To be published by Plenum Press.
- *28) "Thin films of Y-Ba-Cu-O grown in-situ at low temperatures by co-evaporation and plasma oxidation"
A.L. de Lozanne, A.B. Berezin, S. Pan, R.M. Silver, and E. Ogawa, Proc. X Winter Meeting on Low Temp. Phys., Jan 15-18, 1989, Morelos, Mexico. (World Scientific. Pub., New Jersey, 1988) To appear.
- *29) "Scanning tunneling microscopy of thin films of high temperature superconductors".
Alex de Lozanne
Mod. Phys. Lett. B 3, Feb. 1989 (World Scientific. Pub., New Jersey, 1989)
- *31) "Thin films of Y-Ba-Cu-O grown in-situ at low temperatures by co-evaporation and plasma oxidation"
A.L. de Lozanne, Proc. Tsukuba Seminar on High T_c Superconductivity, May 31-June 2, 1989, Tsukuba, Ibaraki, Japan
- *32) "Low Temperature Synthesis of Y-Ba-Cu-O Thin Films"
A.L. de Lozanne, A.B. Berezin, S. Pan, R.M. Silver, and E. Ogawa, Proc. 2nd Workshop on High Temperature Superconducting Electron Devices, June 7-9, 1989, Hokkaido, Japan
- *33) "Synthesis and Characterization of Thin films of High Temperature Superconductors"
Alex de Lozanne
Proc. SAMPE Third Annual Electronic Mat. and Proc. Conf., June 20-22, 1989, Los Angeles, CA.
- 35) "**Thin Films of Y-Ba-Cu-O Grown In-Situ by Co-Evaporation and Plasma Oxidation**"
A.B. Berezin, E. Ogawa, S. Pan, R.M. Silver, and A.L. de Lozanne, Proc. Mat. & Mech. Supercond. Conf., Stanford, CA, July 24-28, 1989. W. Harrison, N. Phillips, and R. Shelton, eds., Physica C (North Holland)

PROFESSIONAL STAFF

- 1) Supported by this grant:
Richard M. Silver, graduate student
- 2) Not supported by this grant
Alan Berezin, graduate student
Ennis Ogawa, graduate student
Logan Brashear, undergraduate student
Prof. Alex de Lozanne, Principal Investigator

INTERACTIONS

Oral presentations on the synthesis of high temperature superconducting films and on tunneling into these materials were given as follows (* = INVITED):

- 1)* Stanford University, June 10, 1988
- 2) Scanning Tunneling Microscopy Internat. Conf., Oxford, UK, July 4, 1988
- 3)* Austin Summerfest, Austin, TX, Aug. 6, 1988
- 4) Applied Superconductivity Conf., San Francisco, Aug. 25, 1988
- 5)* ASM meeting, Houston, TX, Oct. 4, 1988.
- 6)* MRS/ISHM (Int. Soc. Hybrid Microelectr.), Dallas, TX, Oct. 5, 1988.
- 7)* Electrochemical Soc. Meet., Chicago, IL, Oct. 11, 1988.
- 8)* Conf. Science and Technol. of Thin Film Supercond. (SERI), Colorado Springs, CO, Nov 16, 1988.
- 9)* Yale University, March 8, 1989
- 10) March Meeting of the American Physical Society, Saint Louis, MO, March 20-24, 1988 (Two talks)
- 11)* MCC (Microelectr. & Comp. Tech. Corp), April 7, 1989
- 12)* Meeting of the International Society for Hybrid Materials, April 12, 1988, Dallas, TX.
- 13)* Tsukuba University, Japan, June 1, 1989
- 14)* ETL (Electrotechnical Lab.) Japan, June 2, 1989
- 15)* SAMPE (Soc. Advancement in Materials and Process Eng.), Los Angeles, June 21, 1989
- 16)* NEC (Nippon Electric Co.) Tsukuba, Japan, July 7, 1989

Accession For	
NTIS GRA&I	<input checked="" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
By	
Distribution/	
Availability Codes	
Dist	Avail and/or Special
A-1	

