

– JOHN C. BRAVMAN –
BING CENTENNIAL PROFESSOR, STANFORD UNIVERSITY
MATERIALS SCIENCE & ENGINEERING, AND, BY COURTESY, ELECTRICAL ENGINEERING
FREEMAN–THORNTON VICE PROVOST FOR UNDERGRADUATE EDUCATION
DEAN OF THE FRESHMAN–SOPHOMORE RESIDENTIAL COLLEGE

GENERAL INFORMATION

Born New York City, New York
24 July 1957

Address Sweet Hall, 4th Floor
590 Escondido Road
Stanford, CA 94305
bravman@stanford.edu

RESEARCH INTERESTS & EXPERTISE

- Integrated circuit manufacturing
- IC failure processes and phenomena
- Mechanical behavior of thin films
- High spatial resolution materials analysis
- Microelectronic packaging
- IP analysis and litigation

EDUCATION

1975 – 1979 B.S., Materials Science and Engineering, Stanford University

1979 – 1984 M.S., Ph.D., Materials Science and Engineering, Stanford University

PROFESSIONAL CAREER

1979 – 1984 Research Engineer, Fairchild Semiconductor Research Laboratory, Palo Alto, CA

1985 – 1991 Assistant Professor, Dept. of Materials Science & Engineering, Stanford University

1991 – 1995 Associate Professor, Dept. of Materials Science & Engineering, Stanford University

1991 – 1995 Assc. Chairman, Dept. of Materials Science & Engineering, Stanford University

1992 – 1993 Associate Dean for Undergraduate Affairs, School of Engineering, Stanford Univ.

1993 – 2001 Senior Associate Dean, School of Engineering, Stanford University

1995 – *present* Professor, Dept. of Materials Science & Engineering, Stanford University

1996 – 1999 Chairman, Dept. of Materials Science & Engineering, Stanford University

1998 – 1999 Director, Center for Materials Research, Stanford University

1999 – *present* Dean of the Freshman/Sophomore College, Stanford University

1999 – *present* Vice Provost for Undergraduate Education, Stanford University

2001 Interim Vice Provost for Student Affairs, Stanford University

2001 – *present* Professor, by courtesy, Dept. of Electrical Engineering, Stanford University

HONORS AND AWARDS

1987	School of Engineering Distinguished Advisor Award, Stanford University
1988	Excellence in Teaching Award, Society of Black Scientists & Engineers
1989	Walter J. Gores Award for Excellence in Teaching, Stanford University's highest award for teaching
1990	Tau Beta Pi Engineering Honor Society Award for Excellence in Undergraduate Engineering Teaching, Stanford University
1991	Bradley Stoughton Award, ASM International, a national teaching award for scientists under the age of 35.
1992 – 1995	Bing Teaching Fellow, Stanford University
1992	Excellence in Teaching Award, Society of Women Engineers, Stanford Univ.
1994	President, Materials Research Society
1995 – 1997	University Fellow, Stanford University
1997	Bing Centennial Professor, Stanford University
2001	Stanford Associates Award for Service to the Alumni Association
2004	Woody White Award, Materials Research Society

EXTERNAL SERVICE AND SCHOLARLY ACTIVITIES

1986 – 1987	Symposium Organizer, 1987 Fall Meeting of the Materials Research Society; “Workshop on Specimen Preparation for Transmission Electron Microscopy of Materials”
1987 – 1988	Symposium Organizer, 1988 Fall Meeting of the Materials Research Society; “Thin Films: Stresses and Mechanical Properties”
1988 – 1989	Organizing Committee, International Conference on Materials and Mechanisms of Superconductivity – High Temperature Superconductivity
1988 – 1989	Symposium Organizer, 1989 Meeting of the Electron Microscopy Society of America: “Structure and Reactivity of Metal – Semiconductor Interfaces”
1989 – 1990	Conference Chairman, 1990 Spring Meeting of the Materials Research Society
1989 – 1990	Symposium Organizer, 1990 Spring Meeting of the Materials Research Society: “Laser Ablation for Thin Film Synthesis”
1989 – 1990	Symposium Organizer, 1990 Spring Meeting of the Materials Research Society: “Frontiers of Materials Science”
1990 – 1991	Symposium Organizer, 1991 Fall Meeting of the Materials Research Society; “Thin Films: Stresses and Mechanical Properties III”
1990 – 1991	Symposium Organizer, 1991 Fall Meeting of the Materials Research Society; “Workshop on Specimen Preparation for Transmission Electron Microscopy of Materials III”
1991 – 1993	Council Member, Materials Research Society
1991 – 1992	Symposium Organizer, 1992 Spring Meeting of the Materials Research Society: “Structure and Defects in Electronic Oxides”
1991 – 1996	Technical Editorial Board, Materials Research Society Bulletin
1992	Second Vice President, Materials Research Society
1992 – 1998	Editorial Board, Annual Reviews of Materials Science

1992	Guest Editor, July 1992 Issue of the Materials Research Society Bulletin; “Mechanical Properties of Thin Film Materials”
1993	First Vice President, Materials Research Society
1993 – 1995	Selection Committee, Bradley Stoughton Award, ASM International
1993, 2001	Member, National Advisory Board, Materials Science & Technology Programs, Sandia National Laboratories
1994	President, Materials Research Society
1994 – 1995	Conference Organizer, 3 rd International Workshop on Stress Induced Phenomena, Stanford, CA
1995 – 1998	Solid States Sciences Committee of the National Research Council
1996 – 1999	Awards Committee, ASM International
1996 – 1999	Chair, Program Development Subcommittee, Materials Research Society
1996 – 1999	Member, Electronics and Photonics Program National Advisory Board, Sandia National Laboratories
1997 – 1998	Symposium Organizer, 1998 Spring Meeting of the Materials Research Society, “Materials Reliability in Microelectronics VIII”
1997 – 1998	Conference Organizer, 15 th Biennial Conference on National Materials Policy, Washington, D.C.
1998 – 1999	Program Committee, 5 th International Workshop on Stress Induced Phenomena, Stuttgart, Germany
1998 – 1999	Chair, Long Range Planning Committee, Materials Research Society
1998 – 2001	Member, Editorial Board, Applied Physics Reviews
1998 – 2006	Associate Editor, Annual Reviews of Materials Science
2000 – 2004	Chair, Program Committee, Materials Research Society
2001	Member, Middle States Association Accreditation Review Panel, Cornell University
2001	Member, Middle States Association Accreditation Review Panel, University of Pennsylvania
2002 – present	Visiting Committee, Massachusetts Institute of Technology
2002 – 2006	Member, Director’s Review Board, Chemistry and Materials Science, Lawrence Livermore National Laboratory.
2005 – 2009	Board of Directors, LEAD Program for Underserved Youth
2006 – present	Member, Advisory Board, Journal of Engineering Education

UNIVERSITY SERVICE

1986 – 1992; 96 – present	Freshman Advisor
1991 – 1992	Deans’ Advisory Group, Libraries & Information Resources
1991	Faculty Advisor, Freshman Alcohol Responsibility & Management Program
1991 – 1995	Committee on Residential Computing
1991 – 1997	Steering Committee, Continuing Education Program
1992	Faculty Expenditure Certification Process Task Force
1992 – 1995	Faculty Resident Fellow, Yost House Undergraduate Residence

1992	Search Committee, Director of Environmental Health and Safety
1992 – 1996	Chair, University Committee on Health and Safety
1993 – 1999	Chair, C-AAA Subcommittee on University and Departmental Honors
1993	Search Committee, Director of Residential Education
1993 – 1997	Faculty Senate of the Academic Council
1993 – 1999	Steering Committee, Center for Teaching and Learning
1993 – 1994	President's Commission on Undergraduate Education at Stanford; Chair of Subcommittee on Technology in Teaching and Learning
1993 – 1995	C-ASIS Subc. on Distributed Information & Computing Environment
1994 – 1995	President's Commission on Technology in Teaching and Learning
1994 – 1997	Board of Directors, Faculty Club
1994 – 2003	C-AAA Subcommittee on Academic Standing
1995 – 2004	Faculty Member, Stanford Sophomore College
1995	Search Committee, Dean of Students
1995 – 1996	Faculty Senate Committee on Committees
1995 – 1997	Design Committee for Cultures, Ideas & Values Program
1996	Search Committee, Director of Career Planning and Placement Center
1996 – 1998	Stanford University Board of Trustees Committee on Development
1996 – 1999	Writing Advisory Board
1996 – present	University Undergraduate Advisory Council
1996 – 1997	Residences Task Force
1996 – 1999	Executive Committee, Center for Materials Research
1997	Search Committee, Dean of Admissions & Financial Aid
1997 – 1999	Residence Programs Implementation Group
1998 – 2001	Stanford University Board of Trustees Committee on Nominations
1998 – 1999	Director, Center for Materials Research
1999	Elected Chair, Faculty Senate of the Academic Council
1999 – present	Dean of the Freshman/Sophomore College
1999 – present	Freeman–Thornton Vice Provost for Undergraduate Education
2000	Co–Chair, Search Committee, Dean of Admissions & Financial Aid
2000 – 2001	Provost's Task Force, University Needs Assessment
2000 – 2003	Strategic Planning Board, Cantor Center for the Visual Arts
2001	Search Committee, Dean of Humanities and Sciences
2001	Chair, Search Committee, Vice Provost for Student Affairs
2001	Interim Vice Provost for Student Affairs
2004 – 2005	Co–Chair, Search Committee, Dean of Admissions & Financial Aid
2004 – 2007	Dean of Potter College
2005 – 2006	Search Committee, Director of Athletics
2006	Co–Chair, Stanford Task Force Evaluating Education in the Residences
2006 – 2007	Search Committee, University Registrar
2006 – present	Co–Chair, WASC Reaccreditation Steering Committee

SCHOOL OF ENGINEERING SERVICE

1986 – 1990	EE–ICL Faculty Search Committees (Silicon Processing; Sensors)
1986 – 1992	Radiation Safety Committee

1987 – 1992	School of Engineering Committee on Computers
1991 – 2001	Member of Undergraduate Council
1991 – 2006	Faculty Advisor, Tau Beta Pi Engineering Honor Society
1992 – 1993	MSE–EE Faculty Search Committee (Magnetic Materials & Devices)
1992 – 1994	MSE–Chem. E. Faculty Search Committee (Comput. Materials Science)
1992 – 1993	Associate Dean for Undergraduate Affairs
1992 – 2009	Faculty Advisor, Stanford Solar Car Project
1993 – 2001	Senior Associate Dean for Student Affairs

DEPARTMENT SERVICE

1986 – 1987	Student Faculty Liaison Committee, Dept. of Materials Science
1986 – 1987	Industrial Affiliates Program Committee, Dept. of Materials Science
1986 – 1990	Advanced Degree Committee, Dept. of Materials Science
1986 – 1990	Curriculum Committee, Dept. of Materials Science
1986 – 1991	Project Director, X–ray Diffraction Lab., Dept. of Materials Science
1986 – 1991	Chair, Computer Committee, Dept. of Materials Science
1987 – 1991	Chair, Space and Building Committee, Dept. of Materials Science
1990 – 1995	Chair, Financial Aids Committee, Dept. of Materials Science
1991 – 1995	Associate Chairman, Dept. of Materials Science and Engineering
1996 – 1999	Chairman, Department of Materials Science & Engineering

REFEREE

<i>Journals</i>	Journal of Applied Physics, Applied Physics Letters, Journal of Materials Science, Journal of the Electrochemical Society, Physical Review B, IEEE Electron Device Letters, Journal of Materials Research, Physical Review Letters, Journal of Engineering Education
<i>Agencies</i>	National Science Foundation, Electric Power Research Institute, Air Force Office of Scientific Research, Department of Energy, Army Research Labs, Science and Engineering Research Council (Singapore)

PROFESSIONAL SOCIETY MEMBERSHIPS

American Physical Society	American Society of Metals
Materials Research Society	The Metallurgical Society of AIME
Electron Microscopy Society of America	Institute of Electrical & Electronic Engineers

PATENTS

“Drug Delivery Systems using Mesoporous Oxide Films,” Dimitrios Pantelidis and John C. Bravman, Patent Cooperation Treaty Patent Application, submitted December 2004; Patent Application published October, 2007.

CONSULTING ACTIVITIES – TECHNICAL ADVISORY

1985 – 1987	Fairchild Semiconductor , Palo Alto, CA. (technical consulting)
1986 – 1992	National Semiconductor , Santa Clara, CA. (technical consulting)
1987 – 1990	Intel Corporation , Santa Clara, CA. (technical consulting)
1992 – 2000	Mayfield Fund , Menlo Park, CA. (technical consulting)
1994 – 2002	Chair, National Advisory Board, Materials Science & Technology Programs, Sandia National Laboratories
1998 – 2003	Mohr, Davidow , Menlo Park, CA. (technical consulting)
2001 – 2005	Reflectivity, Inc. , Sunnyvale, CA. (technical consulting)
2003 – 2007	Applied Plasma Lab, Inc. , Santa Clara, CA. (Board of Directors)
2004 – present	Medlogics , Santa Rosa, CA. (technical consulting)
2005 – 2007	Sharefare , Los Altos, CA. (Technical Advisory Board)
2006 – 2008	HSH Nordbank , New York, NY. (technical due diligence)
2007	Virgin Fuels , London, U.K. (technical due diligence)

CONSULTING ACTIVITIES – PATENTS/INTELLECTUAL PROPERTY, TRADE SECRET, PRODUCT LIABILITY

1999 – 2000	Robins, Kaplan, Miller and Ciresi – Atlanta, GA
2001 – present	Perkins Coie – Seattle, WA and Phoenix, AZ
2003 – present	Kirkland & Ellis – New York, NY and Chicago, IL
2003	McDermott, Will & Emery – Orange County, CA
2003 – 2004	Jones Day – Dallas, TX and Los Angeles, CA
2004 – 2005	Heller Erhman White & McAuliffe – San Francisco, CA
2004 – 2005	Paul, Hastings, Janofsky & Walker – San Diego, CA
2005 – 2006	Townsend and Townsend and Crew – Palo Alto, CA
2005 – 2007	Keker and Van Nest – San Francisco, CA
2005 – 2008	Fish and Richardson – San Diego, CA
2006 – present	Irell & Manella – Los Angeles, CA
2006 – present	Sheppard, Mullin, Richter, & Hampton – Los Angeles, CA
2006 – 2008	Foley & Lardner – Palo Alto, CA
2007 – 2009	Baker Botts – New York, NY
2007 – 2008	Wolf, Greenfield & Sacks – Boston, MA
2009 – 2010	Morrison Foerster – Palo Alto, CA
2009 – present	Gibson, Dunn – Dallas, TX
2009 – present	Winston & Strawn – San Francisco, CA
2009 – present	O'Melveny & Meyers – San Francisco, CA
2010 – present	Farella Braun & Martel LLP – San Francisco, CA

DOCTORAL STUDENTS OF PROF. JOHN C. BRAVMAN

	<u>Name</u>	<u>Dissertation Title</u>	<u>Completion Date</u>
1.	David C. Paine	A Microstructural Study of LPCVD Tungsten Thin Films for Use as a Contact Material to Silicon.	<i>September 1988</i>
2.	Ming Bing Chang	Deep Level Related Studies in GaAs with the Constant Capacitance Voltage Transient Technique.	<i>October 1989</i>
3.	Soonil Hong	Free Standing Multilayer Thin Film Microstructures for Electronic Systems.	<i>December 1990</i>
4.	Bruce M. Lairson	Critical Currents and Flux Creep in YBa ₂ Cu ₃ O _{7-δ} Superconducting Thin Films.	<i>August 1991</i>
5.	Paul L. Meissner	Barrier Height Reduction and Interface Chemistry in Pd-Ge Based Contacts to GaAs.	<i>August 1991</i>
6.	Ramnath Venkatraman	Plasticity and Flow Stresses in Al Thin Films on Silicon.	<i>May 1992</i>
7.	Stephen K. Streiffer	Nucleation and Growth of YBa ₂ Cu ₃ O _{7-δ} Films on Lattice-Matched and Mismatched Substrates.	<i>November 1992</i>
8.	Paul R. Besser	X-ray Determination of Thermal Strains, Stresses, and Relaxation in Passivated Al Lines During Thermal Cycling	<i>August 1993</i>
9.	Thomas N. Marieb	In-Situ Observations of Void Nucleation and Growth in Passivated Metal Lines	<i>January 1994</i>
10.	Richard Vinci	Thermal Stresses and Strains in Copper Films and Interconnect Structures	<i>August 1994</i>
11.	Cynthia Lee	Diffusion of Implanted Dopants in GaAs/AlGaAs.	<i>December 1994</i>
12.	Eden Zielinski	The Influence of Strain Energy on Abnormal Grain Growth in Copper Thin Films	<i>August 1995</i>
13.	Yaser M. Haddara	Transient Diffusion of Dopants in Gallium Arsenide	<i>March 1997</i>
14.	Charlie Yu	High Temperature Mechanical Properties of Thin Films used in VLSI Fabrication	<i>August 1997</i>
15.	Samantha Lee	The Effects of Passivation on Electromigration Behavior in Aluminum Interconnects	<i>August 1998</i>
16.	Jonathan Doan	In-Situ Studies of Electromigration in Thin Films	<i>December 1998</i>
17.	Guido Cornella	Monotonic and Cyclic Testing of Thin Film Materials	<i>December 1998</i>
18.	Seok Hee Lee	Electromigration in Cu Thin Films	<i>December 2000</i>

19.	Nicole Meier	Electromigration in Cu Thin Films	March 2002
20.	Dimitrios Pantelidis	Mechanisms of Adhesion of Organic/Inorganic Interfaces Reinforced by Silane Coupling Agents and Self-Assembling Mesoporous Oxide Thin Films	June 2003
21.	Ping Zhang	Thin Film Mechanical Behavior	May 2003
22.	Bryan Valek	Thin Film Mechanical Behavior	March 2003
23.	Maura Jenkins	Selection and Use of Silane Adhesion Promoters in Microelectronic Packaging	June 2003
24.	Gaurav Verma	Laser Silicidation for Deep Submicron MOSFETs	August 2003

INVITED PRESENTATIONS AT CONFERENCES, WORKSHOPS, ETC.

1. *March 1985* "High Resolution Microstructural Studies of VLSI Interfaces," Electronic Materials Symposium, Northern California Section, AIME, Santa Clara, CA.
2. *October 1985* "Microstructural Characterization of LPCVD Tungsten Interfaces," Second Annual Workshop on Tungsten & Other Refractory Metals, Albuquerque, NM.
3. *January 1986* "High Resolution Microstructural Studies of Semiconductor Materials," 1986 Annual Meeting of the Society of Photo-Optical Instrumentation Engineers, Los Angeles, CA.
4. *February 1987* "High Resolution Microstructural Studies of Semiconductor Materials," Golden Gate Materials Technology Conference, San Francisco, CA.
5. *June, 1987* "Structural Characterization of Silicon – LPCVD Tungsten Interfaces," 13th Western Regional Meeting for Electron Microscopy and Microbeam Analysis, Concord, CA.
6. *July 1987* "TEM Studies of Semiconductor Materials," Annual Meeting of the International Metallographic Society, Monterey, CA.
7. *September 1987* "Synthesis and Properties of Superconducting Parasites," Regional Meeting of the Materials Research Society, Univ. of Washington, Seattle, WA.
8. *January 1988* "TEM Studies of VLSI Materials," Northern California American Vacuum Society Thin Film Microanalysis Seminar, San Jose, CA.
9. *January 1988* "Synthesis and Properties of Superconducting Perovskites," 1988 Annual Meeting of The Metallurgical Society, Phoenix, AZ.
10. *April 1988* "Morphology and Microstructure of LPCVD Tungsten Films," 1988 Spring Meeting of the Materials Research Society, Reno, NV.
11. *September 1989* "High Resolution Electron Microscopy of Semiconductor Interfaces," 12th Brazilian Congress on Electron Microscopy, Rio de Janeiro, Brazil.
12. *April 1990* "Beam Deflection Techniques for Studying Thin Film Mechanical Behavior," 1990 Spring Meeting of the Materials Research Society, San Francisco, CA.

13. *June, 1991* "Mechanical Testing of Thin Films," 6th International Conference on Solid State Sensors and Actuators," San Francisco, CA.
14. *November 1991* "Mechanical Properties of Thin Film Aluminum," American Vacuum Society Annual Meeting, Seattle, WA.
15. *March 1992* "Mechanical Testing of Thin Film Media," The Metallurgical Society Annual Meeting, San Diego, CA.
16. *April 1992* "Mechanical Testing of Thin Film Materials," 1992 Spring Meeting of the Materials Research Society, San Francisco, CA.
17. *March 1993* "X-ray Determination of Strains, Stresses and Relaxation in Interconnection Metallizations," Second International Workshop on Stress Induced Phenomena in Metallizations, Austin, TX.
18. *June 1994* "Microstructure and Stresses in Sputtered Copper Films," Symposium on Micromechanisms in Stressed Conductor Lines and Thin Films, Ringberg, Germany.
19. *December 1994* "In-situ Electromigration Testing of Aluminum Metallizations," 1994 Fall Meeting of the Materials Research Society, Boston, MA.
20. *April 1995* "Development of High Voltage SEM for In-situ Electromigration Testing," 1995 Spring Meeting of the Materials Research Society, San Francisco, CA.
21. *May 1995* "Development of High Voltage SEM for In-situ Electromigration Testing," 1995 Meeting, European Materials Research Society, Strasbourg, France.
22. *September 1998* "In-Situ High Voltage Scanning Electron Microscopy for Electromigration Studies," 14th Quadrennial International Conference on Electron Microscopy, Cancun, Mexico.
23. *June 2001* "Micromechanical Testing of Free Standing Thin Films for MEMS Applications," 2001 Mechanics and Materials Conference, San Diego. (Keynote)
24. *June 2001* "In-Situ Dynamic Studies of Electromigration in Copper Metallizations," 2001 Mechanics and Materials Conference, San Diego. (Keynote)
25. *December 2001* "Micromechanical Testing of Free Standing Thin Films for MEMS Applications," 2001 Fall Meeting of the Materials Research Society, Boston, MA.

INVITED PRESENTATIONS AT UNIVERSITIES, CORPORATIONS, ETC.

26. *December 1984* "Transmission Electron Microscopy of Semiconductor Materials," Department of Materials Science, Oregon Graduate Center.
27. *January 1985* "Transmission Electron Microscopy of VLSI Interfaces," Rockwell International, Semiconductor Products Division, Los Angeles, CA.
28. *January 1985* "Transmission Electron Microscopy: A Tool for VLSI Research," Hewlett Packard Research Laboratories, Palo Alto, CA.
29. *March 1985* "Morphological Aspects of Silicon – Silicon Dioxide VLSI Interfaces," Texas Instruments Central Research Laboratories, Dallas, TX.

30. *October 1987* “Transmission Electron Microscopy of Thin Films and Interfaces,” Department of Materials Science and Mineral Engineering, Univ. of California at Berkeley.
31. *May 1988* “Progress and Prospects in High Temperature Superconductors,” Raychem Corporation, Redwood City, CA.
32. *June 1988* “An Assessment of LPCVD Tungsten for VLSI Metallizations,” Xerox Corp., Palo Alto Research Center, Palo Alto, CA.
33. *April 1989* “Transmission Electron Microscopy: A Tool for VLSI Research,” National Semiconductor Corporation, Santa Clara, CA.
34. *September 1989* “Mechanical Properties of Thin Film Materials,” 12th Brazilian Congress on Electron Microscopy, Rio de Janeiro, Brazil.
35. *October 1989* “Mechanical Properties of Thin Film Materials,” Motorola Corporation, Phoenix, AZ.
36. *February 1991* “Microstructural Studies of Y–Ba–Cu–O High T_c Thin Films,” 1991 Stanford Symposium on Applications of Contemporary Electron Microscopy, Stanford, CA.
37. *May 1991* “Mechanical Testing Techniques for Thin Film Structures,” Microelectronics Center of North Carolina, Research Triangle Park, NC.
38. *September 1991* “Processing and Structure of Y–Ba–Cu–O High T_c Thin Films,” Physical Sciences Colloquium, IBM Almaden Research Center, San Jose, CA.
39. *November 1991* “Mechanical Properties of Thin Films,” Department Colloquium, Materials Science and Engineering, U. C. Berkeley.
40. *March 1992* “Mechanical Testing of Thin Film Media,” Department Colloquium, Materials Science and Engineering, University of Southern California, Los Angeles, CA.
41. *November 1992* “Mechanical Testing Techniques for Thin Film Structures,” Opening Dedication Ceremony, Max Planck Institut, Stuttgart, Germany.
42. *November 1992* “Micron–Scale Mechanical Testing of Films and Layered Media,” Opening Dedication Ceremony, Max Planck Institut für Metallforschung; Stuttgart, Germany.
43. *September 1993* “Modern Techniques for Surface and Interface Analysis,” National Defense Academy, Japan.
44. *October 1993* “X-ray Methods for Determining Strains and Stresses in Thin Films and Interconnection Lines,” AFOSR Workshop on Stress and Reliability in Thin Film and Optical Materials, The Aerospace Corporation, Los Angeles, CA.
45. *October 1995* “Development of High Voltage SEM for In-situ Electromigration Testing,” University of California at Los Angeles.
46. *November 1996* “Development of High Voltage SEM for In-situ Electromigration Testing,” University of Michigan at Ann Arbor.
47. *August, 1997* “How to be an Effective Engineering Educator,” Linkoping University, Sweden
48. *August 1997* “How to be an Effective Engineering Educator,” Upsala University, Sweden

- 49. *August 1997* High Voltage Scanning Electron Microscopy for In-situ Electromigration Testing,” Royal Institute of Technology, Sweden
 - 50. *November 1997* High Voltage Scanning Electron Microscopy for In-situ Electromigration Testing,” Georgia Institute of Technology.
 - 51. *February 1998* “The Future of Engineering Education at Major Research Universities: Course Correction or New Paradigm?” Symposium on Engineering Education for the 21st Century, Nagoya, Japan.
 - 52. *March 1998* “Quantitative Assessments of Electromigration Lifetime,” Lehigh Univ.
 - 53. *November 1998* “A New Method for Studying Electromigration in IC Interconnects,” Lawrence Berkeley Laboratory, Advanced Light Source Colloquium Series.
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PUBLICATIONS

ARCHIVAL REFEREED JOURNALS

1. "TEM Studies of the Polycrystalline Silicon – Silicon Dioxide Interface," J.C. Bravman and R. Sinclair, *Thin Solid Films*, 104, 153–61 (1983).
2. "Observation of Rapid Field Aided Diffusion of Silver in Metal Oxide Semiconductor Structures," J.D. McBrayer, R.M. Swanson, T.W. Sigmon and J.C. Bravman, *Applied Physics Letters*, 43, 653–54 (1983).
3. "The Preparation of Cross-section Specimens for Transmission Electron Microscopy," J.C. Bravman and R. Sinclair, *Journal of Electron Microscopy Technique*, 1, 52–61 (1984).
4. "Structure and Morphology of Polycrystalline Silicon – Single Crystal Silicon Interfaces," J.C. Bravman, G.L. Patton and J.D. Plummer, *Journal of Applied Physics*, 57, 2279–82 (1985).
5. "Physics, Technology and Modeling of Polysilicon Emitter Contacts for VLSI Bipolar Transistors," G.L. Patton, J.C. Bravman and J.D. Plummer, *IEEE Transactions on Electron Devices*, ED-33, 1754–68 (1986).
6. "Damage Calculation and Measurement for GaAs Amorphized by Si-Implantation," W.G. Opyd, J.F. Gibbons, J.C. Bravman and M.A. Parker, *Applied Physics Letters*, 49, 974–976 (1986).
7. "Observations of Beta-tungsten deposited by Low Pressure Chemical Vapor Deposition," D. C. Paine, J.C. Bravman and C. Y. Yang, *Applied Physics Letters*, 50, 498–500 (1987).
8. "The Mechanical Deflection of Cantilever Microbeams: A New Technique for Testing the Mechanical Properties of Thin Films," T. P. Weihs, S. Hong, J.C. Bravman and W.D. Nix, *Journal of Materials Research*, 3, 931–942 (1988)
9. "Molecular Beam Epitaxy of Layered Dy–Ba–Cu–O Compounds," D. G. Schlom, J. N. Eckstein, E. S. Hellman, S.K. Streiffer, J. S. Harris, M. R. Beasley, J.C. Bravman, T. H. Geballe, C. Webb, K. von Dessionneck and F. Turner, *Applied Physics Letters*, 53, 1660–1662. (1988).
10. "Microstructural Characterization of $\text{YBa}_2\text{Cu}_3\text{O}_{7-d}$ Thin Films on SrTiO_3 Using Four Axis X-ray Diffraction," J. Sizemore, R. Barton, A. Marshall and J.C. Bravman, *IEEE Transactions on Magnetics*, 25 (2), 2245–2249 (1989).
11. "Determination of High Field Enhanced Emission Rates with the Constant Capacitance–Voltage Transient Technique," M.B. Chang, H. Tomokage, J.J. Shiau, R. H. Bube, and J.C. Bravman, *Journal of Applied Physics*, 65, 2734–2738 (1989).
12. "Phase Characterization of Dysprosium Barium Copper Oxide Thin Films Grown on Strontium Titanate by Molecular Beam Epitaxy," E. S. Hellman, D. G. Schlom, A. F. Marshall, S.K. Streiffer, J. S. Harris, M. R. Beasley, J.C. Bravman and T. H. Geballe, *Journal of Materials Research*, 4, 476–95 (1989).
13. "Elimination of Current Dissipation in High Transition Temperature Superconductors," J.Z. Sun, B. Lairson, C.B. Eom, J.C. Bravman and T.H. Geballe, *Science*, 247, 307–309 (1990).
14. "Microwave Properties of Highly Oriented $\text{YBa}_2\text{Cu}_3\text{O}_{7-d}$ Thin films," A. Inam, X.D. Wu, L. Nazar, M.S. Hegde, C.T. Rogers, T. Venkatesan, R.W. Simon, K. Daly, H. Padamsee, J. Kirchgessner, D. Moffat, D. Rubin, Q.S. Shu, D. Kalolitis, A. Fathy, V. Pendrick, R. Brown, B. Brycki, E. Belohoubek, L. Drabek, G. Gruner, R. Hammond, F. Gamble, B.M. Lairson and J.C. Bravman, *Applied Physics Letters*, 56, 1178–80 (1990).
15. "Reduction of Magnetization Decay Rate in High T_c Superconductors," B. Lairson, J.Z. Sun, J.C. Bravman and T.H. Geballe, *Physical Review B*, 42, 1008–1011 (1990).
16. "Measuring Stiffnesses and Residual Stresses of Silicon Nitride Thin Films," S. Hong, T.P. Weihs, J.C. Bravman and W.D. Nix, *Journal of Electronic Materials*, 19, 903–909 (1990).
17. "Molecular Beam Epitaxial Growth of Layered Bi–Sr–Ca–Cu–O Compounds," D. G. Schlom, A. F. Marshall, J.T. Sizemore, Z.J.Chen, J. N. Eckstein, I. Bozovic, K.E. von Dessionneck, J.S.

- Harris and J.C. Bravman, *Journal of Crystal Growth*, 102, 361–375 (1990).
18. “Mechanical Properties and Microstructural Characterization of Al–0.5% Cu Thin Films,” R. Venkatraman, J.C. Bravman, P.W. Davies, P.A. Flinn, D.B. Fraser and W.D. Nix, *Journal of Electronic Materials*, 19, 1231–7 (1990).
 19. “The Microstructure of Fe and Ag Thin Films Grown by Molecular Beam Epitaxy on GaAs (001),” C.J. Chien, R.F.C. Farrow and J.C. Bravman, *Journal of Applied Physics*, 68, 4343–5 (1990).
 20. “Vortex Pinning by Twin Boundaries in $\text{YBa}_2\text{Cu}_3\text{O}_{7-d}$ Thin Films,” B.M. Lairson, S.K. Streiffer and J.C. Bravman, *Physical Review B*, 42, 10067–74 (1990).
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