

## Vinayak P. Dravid, PhD

*Abraham Harris Chaired Professor*

*Department of Materials Science & Engineering*

*McCormick School of Engineering and Applied Science*

Founding Director, NUANCE Center & SHyNE Resource

Founder and Co-director; Global McCormick

### **Northwestern University**

Cook Hall; 2220 Campus Drive, Room 1133

Evanston, IL 60208

<http://www.nuance.northwestern.edu>

<http://www.northwestern.edu/vpdgroup>

<https://www.mccormick.northwestern.edu/global/>

Media Inquiries: (847) 467-1363

E-mail: [v-dravid@northwestern.edu](mailto:v-dravid@northwestern.edu)



### **Education and Training:**

IIT Bombay	Bombay, India	Metallurgical Engineering	B.S. Tech.	1984
Lehigh University	Bethlehem, PA	Materials Science & Engineering	Ph.D.	1990

### **Interweaving Research, Education & Outreach Theme**

Vinayak's scholarly interests revolve around "imaging" across diverse length-scales and disparate phenomena; from atoms to animals and from arts to astronomy. His research spans a wide spatial range - from atomic-scale imaging with electron microscopy to animal imaging with magnetic resonance imaging (MRI). His education and outreach contributions encompass microscopy and characterization of arts and artifacts as well as dynamic imaging, methodologies and algorithms inspired by astronomy.

His passion for facilities and instrumentation infrastructure has brought global leadership in the broad field of imaging to Northwestern and the Chicago region. He is a tireless advocate of "inclusive innovation" and committed to enhancing the societal and global appreciation for science and technology through the visually appealing medium of imaging.

### **Specific Research & Scholarly Interests and Contributions**

- Development, implementation and application of novel electron, ion, photon & probe microscopy for hard, soft and hybrid materials, structures and devices.
- Predictive structure-property & form-function relationships at molecular/atomic scale.
- Novel assembly and characterization approaches to "soft" and "hybrid" materials.
- Nanopatterning & nanostructures for biomedicine, energy and sensor applications
- Facilities/instrumentation as catalyst for innovation and corporate partnership

### **Academic Philosophy**

- *Beyond Knowledge* - Emphasis on creativity, communication and innovation
- Inter-disciplinary, cross-disciplinary, collaborative and teamwork approach; rooted in independent, individual creativity and aspirations
- Seamless integration of research, education and societal outreach; with an emphasis on local and global engagement

- Bloom's Taxonomies for 21<sup>st</sup> Century: synthesis, analysis, creativity and communication

### Professional Appointments and Education

2016-Present	Founding Director, Soft & Hybrid Nanotechnology Experimental (SHyNE) Resource <i>NSF Center of Excellence in Facility Infrastructure in MidWest</i>
2015-Present	Founder, Past Director and Current Co-Director, Global McCormick Initiative (GMI) <i>Conceived, developed and nurtured global research and educational initiatives</i>
2012-Present	President Abraham Harris Chaired Professor; Materials Science and Engineering, Northwestern University
2009-2010	Kellogg School of Management, Executive Development; <i>"Management Skills for Innovative University Leaders"</i>
2000-Present	Full Professor, Materials Science and Engineering, Northwestern University
2001-Present	Founding Director, Northwestern University Atomic and Nanoscale Characterization Experimental (NUANCE) Center
1995-Present	Director, Electron Probe Instrumentation Center (EPIC)
1995-2000	Associate Professor, Materials Science and Engineering, Northwestern University
1990-1995	Assistant Professor, Materials Science and Engineering, Northwestern University
1985-1990	Graduate Research Assistant, Lehigh University, PhD in MS & E, <i>Advisors: Profs. Michael R. Notis and Charles E. Lyman</i>
1984-1985	Research Engineer, Morris Electronics, India; Development of magnetic ferrites
1979-1984	B.S. Tech, Metallurgical Engg., Indian Institute of Technology (IIT) Bombay, India

### Notable Positions, Honors & Awards:

2020	Annual Highly Cited researchers List by Clarivate Analytics
2019	Fellow, The Microanalysis Society, Inaugural Class of 2019
2018	Annual Highly Cited researchers 2018 List by Clarivate Analytics
2017	Fellow, Royal Microscopical Society, UK.
2014	Elected Honorary Member, The Indian Institute of Metals (IIM), India
2014	Gold Star Award; Core Facilities, for consistent excellence every year since inception
2012	Lee Hsuen Research Fellowship, Chinese Academy of Sciences, PRC
2012	IIT Bombay Distinguished Alumnus Award, India
2011	Elected Faculty Honor Roll for Excellence in Teaching: Northwestern University; Selected by voting UG students for several years
2011	Elected Honorary Member, Materials Research Society of India (MRSI)
2010	Elected Fellow, American Association for Advancement of Science (AAAS)
2010	Elected Fellow, Materials Research Society (MRS)
2010	Elected Fellow, American Physical Society (APS)
2010	Elected Faculty Honor Roll for Excellence in Teaching: Northwestern University; Selected by voting UG students
2009	Elected Fellow, Microscopy Society of America (MSA) - Inauguration Class
2009-	Elected Faculty Honor Roll for Excellence in Teaching: Northwestern University; Selected by voting UG students – several years
2008	Richard M. Fulrath Award, American and Japanese Ceramics Society
2007	6th McBain Memorial Award, National Chemical Laboratory (NCL), India

2006	First McCormick Faculty Excellence Award, Northwestern University
2005	Outstanding Mentor Award, Westinghouse High School Mentor Program
2003	Elected Fellow, American Ceramic Society
2001-2002	Teacher of the Year, MSE Department, Northwestern University
2001-2002	Visiting Faculty Fellow, ASM-IIM
2001-2002	National Institutes of Health (NIH) Sabbatical Faculty Fellowship
2001	Distinguished Alumnus Service Award, IIT Bombay, India
1999-2000	Speaker of the Year, Microbeam Analysis Society (MAS)
1998	Educational Development Award, The Minerals, Metals & Materials Society (TMS)
1998	Kurt F.J. Heinrich Award, Microbeam Analysis Society (MAS)
1997	Robert L. Coble Award, American Ceramic Society (ACerS)
1996	Burton Medal, Microscopy Society of America (MSA)
1995	Faculty Development Award, IBM
1994	Faculty Fellow, Exxon Foundation
1994	Faculty Fellowship, Oak Ridge National Laboratory's HTML
1993	NSF Young Investigator Award (NYI), NSF

## Selected Leadership Activities

### **Organization and Management**

2016-Present	Director, SHyNE Resource: Soft and Hybrid Nanotechnology Experimental Resource, an NSF-NNCI program, is a national resource that provides academic, SMEs researchers access to cutting-edge nanotechnology facilities and expertise. <a href="http://www.shyne.northwestern.edu">www.shyne.northwestern.edu</a>
2001-Present	Director, NUANCE Center: conceived and implemented a diverse yet integrated characterization instrumentation center, comprising EPIC (electron microscopy), Keck-II (surface science), and NIFTI (scanning probe microscopy), with 30+ major instruments worth \$25+ million. <i>Lead the growth of NUANCE Center from two instruments and &lt;30 users to over 30+ major instruments, 110+ faculty affiliates and 800+ users.</i> <a href="http://www.nuance.northwestern.edu">http://www.nuance.northwestern.edu</a>
2015-Present	Founder and Co-Director, Global McCormick Initiative: conceived, formulated and executed Global McCormick Initiative. <i>An integrated school-wide initiative for global engagement and program development in every continent, with over 70 global programs and interactions.</i> <a href="http://global.mccormick.northwestern.edu">http://global.mccormick.northwestern.edu</a>
2012-2015	Founding Director, Global McCormick Initiative Dean and Provost Advisor: International and Global Outreach. Member: NU Strategic Planning for Globalization
2010-Present	Member: Center for Advanced Molecular Imaging (CAMI) Advisory Board
2010-Present	Member: McCormick Areas of Distinction Committee
2010	Member: N.O.W.: McCormick New Opportunities Workshops. Member: Materials Science & Engineering School Advisory Committee, Nanyang Technological University (NTU) Singapore.
2007-Present	Member: Editorial Advisory Board; Bulletin of Materials Science, Bangalore, India.
2010-2013	Co-Chair: NSEC REU Program and Symposium
2010 - 2015	Member: INVO Innovation & New Ventures Faculty Board

2010- Present Member: College of Engineering Advisory Committee: Nanyang Technological University (NTU) Singapore.

2010-Present Member: Steering Committee, Provost Taskforce on Global Engagement.  
Member: MSE Long Range Planning Committee  
Member: Presidential Circle, Chicago Council on Global Affairs (CCGA).

2005- Present Member: India Biodesign Initiative.  
Member: International Advisory Committee for the International Conference on Nano Science and Technology, (ICONSAT), I.I.T. Bombay, India

2005 - 2015 Member: External Advisory Board: IIT Bombay, India

2010-Present Member: External Advisory Board: Nanyang Technological University (NTU) Singapore.

2003-Present Member: External Advisory Committee, University of Toronto, Province of Ontario

2007-2016 Board of Directors, IIT Bombay Heritage Fund (IITBHF – US Alumni Association of IIT Bombay, India).

2008-2015 Co-founder and Organizer: ASME Nano Bootcamp, ASME-NU Initiative.

2003-2015 Board Member: NanoInk Scientific Advisory Board

2004-Present Member: Robert H. Lurie Comprehensive Cancer Center.

2008-2015 Founder, Board Member and Chair Scientific Advisory Committee: NanoSonix, Inc., a high-tech start-up.

2008-Present Member: Northwestern University Chemistry of Life Processes (CLP) Corporate & International Outreach/Entrepreneurial Activities Committee.

2008-2013 Member: NU Imaging Advisory Committee.

2009-2013 Co-Chair: NSEC Annual Meeting.

2009-2015 International Advisory Committee: Global Indian Scientists and Technocrats Convention (GIST).

### ***Recent Scientific and Technical Leadership***

2001-Present Co-Founder, steering committee member, Associate Director for Global Programs: International Institute for Nanotechnology (IIN)

2001-2008 Founding member and Co-PI on original proposal, NSF-NSEC

2009-2013 Group Leader, Interdisciplinary Research Group (IRG) of NU NSF-MRSEC

2005-Present Scientific Advisor and Technical Consultant, Art Institute and Museum of Science and Industry, Chicago, Illinois

2009-Present Technical Advisor and Committee Member, Chemistry of Life Processes Institute

2005-Present Developer and Instructor, New Curriculum for Kellogg School of Management (KSM) related to Emerging Technologies

2015-present Initiated Integration: Journalism, (Medill School), Communication (School of Communication) and Business (Kellogg School of Management) in Engineering and Technology Education

2007-Present Scientific Advisor, Reliance Industries (RIL) and RIL Chairman, Mr. Mukesh Ambani, Global conglomerate with largest market capitalization in India (> \$30b).

2012-Present Member, Australian Microscopy and Microanalysis, Research Facility (AMMRF) International Technical and User Advisory Group

2009-2012 Member, National Institutes of Health Biomedical Technology Review Committee

### **Selected Recent Professional Activities**

2018 Symposium Organizer, Machine Learning, M&M Annual Mtg., Baltimore, MDConference

2016 Chair, National Science Foundation Nanoscale Science & Engineering Conference

2015-16 Mico- and Nanofabrication and Characterization Task Force

Several	Materials Research Society (MRS) Fall Meeting Symposium Organizer
2014-Present	Editorial Board, Current Opinion in Solid State & Materials Science
2012-Present	Editor, Materials Science, Microscopy & Microanalysis, Flagship Journal of the Microscopy Society of America (MSA)
2003-Present	Co-Founder and Instructor: American Society of Mechanical Engineers (ASME) Nano Training Bootcamp
1999-2013	Board of Directors, IIT Bombay Heritage Fund (IITBHF)
1995-Present	Editorial Board Member, <i>Journal of Microscopy</i> (Royal Microscopical Society, UK)

### **Affiliated Professional Societies**

Microscopical Society of America (MSA)

Microbeam Analysis Society (MAS)

ASM International

The Minerals, Metals, and Materials Society (TMS)

American Ceramic Society (ACerS)

Materials Research Society (MRS)

American Assoc. for the Adv. of Science (AAAS)

American Chemical Society (ACS)

American Physics Society (APS)

Institute of Electrical and Electronics Engineering (IEEE)

American Society of Mechanical Engineers (ASME)

American Society for Engineering Education (ASEE)

Royal Microscopy Society (RMS)

Chicago Council on Global Affairs, President's Circle

### **Educational and Mentoring Activities**

#### ***Philosophy***

Emphasis on Bloom's taxonomies of higher levels of learning and teaching: *creativity, synthesis, analysis and dissemination*.

- Multidisciplinary approach to materials education.
- Attaining excellence in education via integrating research and teaching, as well as communication and IT in the global context.
- Inculcation of societal appreciation for science and technology via community, national and international outreach activities.

#### ***Teaching Interests and Course/Curricula Development***

Introduction to Materials Science & Engineering, Interface and Defect Phenomena in Materials, Introduction to SEM and TEM, Advanced Analytical Electron Microscopy, Physical Ceramics, Symmetry and Physical Properties, Hierarchy of Structures in Biological and Physical Sciences, Nanopatterning of Functional Structures, Business of Nanotechnology, Energy Strategy and Policy.

Advisor to several high school students, as well as REU, MIN, REST and teacher/student interns:

- Prudent use of modern technology in classroom and in distance learning.
- Development of multi-media approach to UG education.
- Emphasis on concept development and hands-on experimental training.

- Faculty Honor Roll voted by UG students: Several Years.
- Teacher of the Year award from MSE department students
- Consistently in top tier of student reviews in courses taught: CTEC (Course and Teacher Evaluation Council). In all categories, typically score in excess of 5 out of 6.

**Graduated Students & Postdoctoral Scholars (40+ PhD graduates, 50+ Postdocs, 20+ MS, over 1500+ UG students in classes and internships)**

V. Ravikumar	PhD	1996	GE, Global R&D, NY
Michelle St. Louis-Weber	PhD	1997	Intel Corp, CA
Elizabeth C. Dickey	PhD	1997	North Carolina State Univ., NC
Jonathan J. Host	PhD	1997	Hemlock Corp., MI
Thomas Isabell	PhD	1998	JEOL, MA
Henry Lippard	PhD	1998	AllVac, Inc., NC
Steven Kim	PhD	1999	EmiSpec Inc., AZ
Richard Rodriguez	PhD	1999	Intel Corp., CA
Kevin Johnson	PhD	2000	Intel Corp., OR
Conal Murray	PhD	2001	IBM Watson Res. Ctr., NY
Xiwei Lin	PhD	2001	Intel Corp., OR
Luke N. Brewer	PhD	2002	University of Alabama, AL
Kevin L. Klug	PhD	2002	CTC Corp., PA
Murat Guruz	PhD	2002	Hitachi-IBM Alliance, CA
Ming Su	PhD	2004	Worcester Polytechnic Inst., MA
Pradyumna Prabhumirashi	PhD	2006	Intel Corp., Santa Clara, CA
Nasim Alem	PhD	2007	Pennsylvania State University, PA
Suresh Donthu	PhD	2007	Exponent Consulting, CA
Zixiao Pan	PhD	2008	Exponent Consulting, CA
Tao Sun	PhD	2009	Argonne National Laboratory, IL
Soo-Hyun Tark	PhD	2010	Intel Corporation, OR
Mengchun Pan	PhD	2012	Intel Corporation, OR
Bin Liu	PhD	2012	Intel Corporation, CA
Aiming Yan	PhD	2013	Zettl Group, UC-Berkeley, CA
Stan Shihyao Chou	PhD	2013	Sandia National Lab, NM
Shraddha Avasthy	PhD	2013	Intel Corporation, OR
Yi-Kai Huang	PhD	2014	Intel Corporation, OR
Shihhan Lo	PhD	2014	Intel Corporation, OR
Jeff Cain	PhD	2017	UC-Berkeley, CA
Karl Hujsak	PhD	2018	Northwestern University, IL
Fernando Castro	PhD	2018	Northwestern University, IL
Ben Meyers	PhD	2018	Yale University, CT
Eve Hanson	PhD	2018	Citrine Informatics, CA
Xiaoming Zhang	PhD	2019	Apple, Inc.
Yue Li	PhD	2019	Northwestern University, IL
Akshay Murthy	PhD	2020	ASM America, AZ
Jann Grovogui	PhD	2021	The Aerospace Corporation
Cesar Villa	PhD	2021	Consultant
Jennifer DiStefano	PhD	2021	Energy Futures Initiative, DC

Nathan Wilcox	MS	1994	Intel Corp., CA
Jinha Hwang	MS	1994	Hongik University, S. Korea
Balaji Chandrasekaran	MS	1999	Applied Materials, CA
Nazir Poonawala	MS	1999	Intel Corp., OR
Ethan Young	MS	2006	Samsung Corp., S. Korea
Michael Miller	MS	2006	Gas Research Institute, IL
Feng Qu	MS	2005	Private Consultant
Ben Murphy	MS	2009	Triton Systems, Boston, MA
Shanwei Fan	MS	2009	Taiwan Semiconductor Manufacturing Co.
James Sbarboro	MS	2011	Neuroquest, Inc., Chicago, IL
David Woo Hyun Chae	MS	2017	Massachusetts Institute of Technology, MA
Aaron Einhorn	MS	2018	Northwestern University
Tzu Hung Chen	MS	2018	Northwestern University, IL
Liren Wang	MS	2019	Northwestern University, IL
Will Kellogg	MS	2019	Intel Corp.
Hong Zhang	Postdoc	1994	Applied Materials, CA
Yun-Yu Wang	Postdoc	1997	IBM Corp., NY
S.C. Cheng	Postdoc	1998	Corning Corp., NY
Weida Qian	Postdoc	1998	Intel Corp., OR
Zhen Liu	Postdoc	1999	Arizona State University., AZ
Yanguo Wang	Postdoc	1999	Beijing University., China
Sylvie Malo	Postdoc	2000	CRSIMAT, CNRS, France
Jinha Hwang	Postdoc	2001	Hongik University, S. Korea
Lei Fu	Postdoc	2002	Photronics, TX
Shu-You Li	Postdoc	2003	Northwestern University, IL
Hao Hu	Postdoc	2007	PriceWaterhouseCoopers, NY
Mohammed Aslam	Postdoc	2007	IIT Bombay, India
Arvind Srivastava	Postdoc	2009	NanoSonix, Inc., IL
Soo-Hyun Tark	Postdoc	2011	Intel Corporation, OR
Mirela Mustata	Postdoc	2011	Northeastern University, MA
Mrinmoy De	Postdoc	2012	Northwestern University, IL
Saurabh Sharma	Postdoc	2012	Northwestern University, IL
Changquiang Chen	Postdoc	2012	University of Iowa, IA
Langli Luo	Postdoc	2013	Pacific Northwest National Laboratory, WA
Fengyuan Shi	Postdoc	2013	University of Illinois at Chicago, IL
Vikas Nandwana	Postdoc	2014	Northwestern University, IL
Shanthi Kanthala	Postdoc	2014	Kashiv Pharm Bridgewater, NJ
Xin Wang	Postdoc	2016	Tianjin University of Technology, China
Qianqian Li	Postdoc	2017	Shanghai University, China
Chiara Musumeci	Postdoc	2017	Linkoping University, Sweden
Neena Gilda	Postdoc	2017	Taiwan Semiconductor Manufacturing
Sungkyu Kim	Postdoc	2018	Brookhaven National Lab, NY
Hee Joon Jung	Postdoc	2018	Northwestern University, IL
Abhalaxmi Singh	Postdoc	2018	University of Illinois at Chicago, IL
Soo Ryoon Ryoo	Postdoc	2018	Dankook University, S. Korea

Yaobin Xu	Postdoc	2018	Pacific Northwest National Laboratory, WA
Poya Yasaei	Postdoc	2018	Exponent Consulting, CA
Qing Tu	Postdoc	2018	Texas A&M, TX
Yuan Li	Postdoc	2018	Northwestern University, China
Paul Das	Postdoc	2021	Univeristy of Pennsylvania
Dilip Agrawal	Postdoc	2021	Indian Institute of Technology Bombay
M. Arslan Shehzad	Postdoc	2021	Georgia Institute of Technology
Dhruv Aggarawal	BS	1994	GE, CT
Jason Ross	BS	1997	Timken Steels, OH
Cyndi Batson	BS	1998	University of California Santa Barbara, CA
April Hixon	BS	1998	Containerless Corp., IL
Howard Gholston	BS/MS	2000	Intel Corp., AZ
Nora Colligan	BS	2002	Samsung Corp., TX
Ethan Chang	BS/MS	2006	Samsung Corp., Korea
Yen Po Lin	BS	2008	Harvard University, MA
Ken D'Aquila	BS	2008	Northwestern University, IL
Felix Richter	BS	2013	Mt. Sinai, NY
Dan Charles	BS	2014	Northwestern University, IL
Conner Dykstra	BS	2014	Sandia National Lab, NM

#### **Representative Funding Support:**

National Science Foundation (NSF); Divisions - DMR, ENG, CMMI, INT, EECS, Chem  
National Science Foundation-Materials Research Science & Engineering Centers (MRSEC)  
National Science Foundation-National Nanotechnology Coordinated Infrastructure (NNCI)  
Air Force Office of Scientific Research (AFOSR)  
Department of Energy (DOE) – Basic Energy Sciences (BES)  
DOE Energy Frontier Research Centers (EFRCs)  
Air Force Center of Excellence (COE)  
DARPA, DOD (ONR, AFOSR, ARO)  
Nanyang Technological University (NTU) Singapore  
Samsung Electronics, IBM, Intel Corp., SRC

#### **Selected Representative Service**

##### ***Department of Materials Science and Engineering***

2017-Present Chair, Department Faculty Awards Committee  
2015- Present Member, Faculty and Center Directors Committee  
2015-Present Member, Search Committee for MSE with IIN Tenure-Track Asst. Professor  
2011-2013 Advisor, Materials Science Student Association (MSSA Graduate Students)  
2005-Present Member, Long Range Planning Committee  
2005-Present Member, Colloquium and Named Lectures Committee

##### ***McCormick School of Engineering***

2015-Present Founder and Co-Director, Global McCormick Initiatives (GMI)  
2013 Member, Biomedical Engineering-Mechanical Engineering Faculty Search Committee  
2011-2015 Founder and Director, Global McCormick Initiative (GMI)  
2009-Present Member, Advisory Board: NU-Niles University, Egypt  
2009-Present Member, McCormick New Initiatives Committee



2008-Present Member, Cancer Center, Program in Engineering and Nanotechnology in Cancer Research  
2007-Present Member, MRSEC Steering Committee  
2005-Present Chair, McCormick Ad-Hoc Committees  
2005-Present Advisor to the Dean, Global Outreach  
1991-Present Faculty Advisor, Local MRS Chapter

### **University**

2015-present Member, Buffett Institute Leadership Search Committee  
2015-present Member, Ryan Fellowship Award Committee  
2011-present Member, Advisory Board for the Tumor Biology Core  
2011-present Member, Nanoscale Science & Engineering Center; Leader, Integrated Bio-Chip  
2009-present Member, Northwestern University Imaging Advisory Committee  
2009-present Member, NU Advisory Committee on Imaging  
2009-present Member, CLP Corporate & International Outreach & Entrepreneurial Activities Committee  
2009-present Member, Global NU Committee  
2009-present Member, Program Review Panel: Core Facilities  
2009-present Member, Robert H. Lurie Comprehensive Cancer Center Translational Working Group  
2009-present Member, International Institute for Nanotechnology (IIN) Steering Committee  
2007-present Member, One Northwestern Committee  
2006-present Member, Provost Committee on NU Globalization Strategy  
2006-present Member, Program Review of Office of VP Research  
2005-present Member, Vice President of Research Committee on Nanoscience and Nanotechnology  
2005-present Member, Minority Outreach Initiative Committee  
2005-present Director, CCNE Nanofabrication Core  
2005-present Member, IBNAM; Co-PI Baxter Incubator Grant  
2001-present Director, NUANCE Center  
1998-present Member, Intellectual Property Committee

### **Facility Leadership**

2015-Present Founding Director, SHyNE Resource  
2001-Present Founding Director, NUANCE Center  
2012-2015 Founding Director, Global McCormick

### **Journal Publications and Book Chapters**

**(590+ archival publications, Google Scholar "h" index 102 as of December 2020)**

601. Li, Y., Eshein, A., Virk, R.K., Eid, A., Wu, W., Frederick, J., VanDerway, D., Gladstein, S., Huang, K., Shim, A.R., Anthony, N.M., Bauer, G.M., Zhou, X., Agrawal, V., Pujadas, E.M., Jain, S., Esteve, G., Chandler, J.E., Bleher, R., de Pablo, J.J., Szeleifer, I., Dravid, V.P., Almassalha, L.M., Backman, V. Nanoscale chromatin imaging and analysis platform bridges 4D chromatin organization with molecular function. **Science Advances** 7(1) (2021), pp.eabe4310, 10.1126/sciadv.abe4310, DOI: 10.1126/sciadv.abe4310.

600. Han, J., Park, J., Bak, S.M., Son, S.B., Gim, J., Villa, C., Hu, X., Dravid, V.P., Su, C.C., Kim, Y., Johnson, C., Lee, E. Pb-Based Nanocomposite Anodes: New High-Performance Pb-Based Nanocomposite Anode Enabled by Wide-Range Pb Redox and Zintl Phase Transition. **Advanced Functional Materials** 31(2) (2021), pp. 2170008 doi.org/10.1002/adfm.202170008.

599. Lee, J., Kim, H., Gautam, L., He, K., Hu, X., Dravid, V.P., Razeghi, M. Study of Phase Transition in MOCVD Grown Ga<sub>2</sub>O<sub>3</sub> from  $\kappa$  to  $\beta$  Phase by Ex Situ and In Situ Annealing **Phototronics**, 8(1) (2021), pp. 17, doi.org/10.3390/photronics8010017, doi.org/10.3390/photronics8010017.

598. Chen, Y., Zhuang, X., Goldfine, E.A., Dravid, V.P., Bedzyk, M.J., Huang, W., Facchetti, A., Marks, T.J. (2020) Printable Organic-Inorganic Nanoscale Multilayer Gate Dielectrics for Thin-Film Transistors Enabled by a Polymeric Organic Interlayer. **Advanced Functional Materials**, 30(40), p.2005069, doi.org/10.1002/adfm.202005069.

597. Zhuang, X., Patel, S., Zhang, C., Wang, B., Chen, Y., Liu, H., Dravid, V.P., Yu, J., Hu, Y.Y., Huang, W., Facchetti, A., and Marks, T.J. (2020) Frequency-Agile Low-Temperature Solution-Processed Alumina Dielectrics for Inorganic and Organic Electronics Enhanced by Fluoride Doping. **Journal of The American Chemical Society**, 142(28), pp. 12440-12452, doi.org/10.1021/jacs.0c05161.

596. Min, S., Jeon, Y.S., Jung, H.J., Khatua, C., Li, N., Bae, G., Choi, H., Hong, H., Shin, J.E., Ko, Han Seok, M.J., Jun, I., Fu, H.E., Kim, S.H., Thangam, R., Song, J.J., Dravid, V.P., Kim, Y.K., and Kang, H. Independent Tuning of Nano-Ligand Frequency and Sequences Regulates the Adhesion and Differentiation of Stem Cells. **Advanced Materials**, 32(40), (2020) P.2004300, doi.org/10.1002/adma.202004300.

595. Luo, Z., Cai, S., Hao, S., Bailey, T.P., Spanopoulos, I., Luo, Y., Xu, J., Uher, C., Wolverton, C., Dravid, V.P., Yan, Q., Kanatzidis, M. Strong Valence Band Convergence to Enhance Thermoelectric Performance in PbSe with Two Chemically Independent Controls. **Angewandte Chemie** 133(1), pp. 272-277 (2020) doi.org/10.1002/ange.202011765

594. Chatterjee, K., dos Reis, R., Harada, J.K., Mathiesen, J.K., LA Bueno, S., Jensen, K.M., Rondinelli, J.M., Dravid, V.P., Skrabalak, S.E. Durable Multimetal Oxychloride Intergrowths for Visible Light-Driven Water Splitting. **Chemistry of Materials**, 33(1) (2020), pp.347-358, doi.org/10.1021/acs.chemmater.0c04037

593. Lim, J.M., Luu, N.S., Park, K.Y., Tan, M. T. Z., Kim, S., Downing, J.R., He, K., Dravid, V.P., Hersam, M.C., Enhancing nanostructured nickel-rich lithium-ion battery cathodes via surface stabilization. **Journal of Vacuum Science & Technology A** 38, 063210 (2020); doi.org/10.1116/6.0000580

592. Xu, X., Barrows, F., Dravid, V.P., Haile, S. M., Phatak, C., Quantifying leakage fields at ionic grain boundaries using off-axis electron holography. **Journal of Applied Physics** 128, 214301 (2020) doi.org/10.1063/5.0031233

591. Dereshgi, S.A, Folland, T.G., Murthy, A.A., Song, X., Tanriover, I., Dravid, V.P., Caldwell, J.D., Aydin, K. Lithography-free IR polarization converters via orthogonal in-plane phonons in  $\alpha$ -MoO<sub>3</sub> flakes. **Nat Commun** 11, 5771 (2020); doi.org/10.1038/s41467-020-19499-x

590. Distefano, J.G., Murthy, A.A., Hao, S., dos Reis, R., Wolverton, C., Dravid, V.P. Topology of transition metal dichalcogenides: the case of the core–shell architecture. **Nanoscale** (2020), Advance Article; DOI: 10.1039/D0NR06660E **Invited Review**.
589. Du, F., Qiao, B., Nguyen, T.D., Vincent M.P., Bobbala, S., Yi, S., Lescott, C., Dravid, V.P., Olvera de la Cruz, M., Scott, E.A. Homopolymer self-assembly of poly(propylene sulfone) hydrogels via dynamic noncovalent sulfone–sulfone bonding. **Nat Commun** 11, 4896 (2020).
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## Patents

**22 patents issued in synthesis of nanostructures, nanopatterning, bio-chemical sensing, metrology, instrumentation, and software control.**

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11. Mirkin, C.M., Hong, S., Dravid, V.P. "Nanolithography Methods and Products Therefore and Produced Thereby". US Patent 7,722,928. Issued 25 May 2010, and US Patent 7,744,963. Issued 29 June 2010.
12. Srivstrava, A., Dravid, V.P. "Light Induced Gas Sensing at Room Temperature." U.S. Patent Application 12,459,193. Issued: 26 June 2009.
13. Aslam, M., Dravid, V.P., Meade, T.J., Shultz, S.E.A, Ulrich, B.D. "Magnetic Resonance Contrast Agent Composition for Pharmaceutical Formulation for Use as Imaging Enhancing Agent for Imaging Cell, Tissue or Cancer Comprises Longitudinal Contrast Agent Portion and Transverse Contrast Agent Portion." International Patent WO2009036441-A2, A3. Issued 19 March 2009.
14. Dravid, V., Mirkin, C.M., Su, M., Liu, X. "Patterning of Solid State Features by Direct Write Nanolithographic Printing." European Patent EP 1 502 154 B1. Issued: 18 February 2009.
15. Shekhawat, G., Dravid, V.P. "Scanning Near Field Ultrasound Holography." U.S. Patent 7,448,269. Issued 11 November 2008.
16. Dravid, V.P., Mirkin, C.M., Su, M., Liu, X. "Patterning of Solid State Features by Direct Write Nanolithographic Printing." U.S. Patent 7,273,636. Issued: 25 September 2007.

17. Mirkin, C.M., Fu, L., Liu, X., Dravid, V.P. "Patterning Magnetic Nanostructures." U.S. Patent 7,223,438. Issued: 29 May 2007.
18. Su, M., Dravid, V.P. "Nanodisk Sensor and Sensor Array." U. S. Patent 7,155,959. Issued 2 January 2007.
19. Dravid, V.P., Shekhawat, G. "Method and System for Electronic Detection of Mechanical Perturbations Using BIMOS Readouts". U.S. Patent 7,157,897. Issued 2 January 2007.
20. Johnson, L.D., Dravid, V.P., Teng, M.H., Host, J.J., Hwang, J., Elliott, B.R. "Nanoparticle Synthesis Apparatus and Method." U.S. Patent 5,665,277. Issued 9 September 1997.
21. Johnson, L.D., Dravid, V.P. "Evaporator Apparatus and Method for Making Nanoparticles." U.S. Patent 5,618,475. Issued 8 April 1997.
22. Dravid, V.P., Teng, M.H., Host, J.J., Elliott, B.R., Johnson, L.D., Mason, T.O., Weertman, J.R., Hwang, J.H.. "Graphite Encapsulated Nanophase Particles Produced by a Tungsten Arc Method." U.S. Patent 5,472,749. Issued 5 December 1995.

### **Invited Talks and Presentations**

#### **2019**

1. "Nanocombinatorics: Multicomponent Multicomponent Multiplexed and Multifunctional Nanostructures," Chevron, March 2019.
2. "Oil Spill Recovery and Heavy Metal Sequestration via Oleophilic, Hydrophobic, and Magnetic (OHM) Sponge", Chevron, March 2019.
3. "Research Facilities as an Innovation Ecosystem," Reliance Insutries, Ltd, March 2019.
4. "Inspiration from Professor CNR Rao: Experimental Materials Genome at the Nanoscale," ChemPhysMat, February 2019.
5. "Seeing the Invisible: Dynamic Interfacial Phenomena in Energy Materials," Fulrath 43<sup>rd</sup> International Conference and Exposition on Advanced Ceramics and Composites, Daytona Beach, FL, February 2019.
6. "Hybrid" Microscopy: Multimodal, Correlative and Dynamic Characterization of Soft and Hybrid Structures – Microscopy and Microanalysis Conference, Portland, USA August/2019

#### **2018**

7. "Multiplexed Nanopatterning of Multifunctional Materials," Southern University of Science and Technology, Shenzhen, China, December 2018.
8. "Welcome to NUANCE, SHyNE, and the VPD Group!" Center for Hierarchical Materials Design Materials Microscopy Data Workshop, Northwestern University, Evanston, IL, October 2018.
9. "Teaching 'Old' Material 'New' Tricks: Nanopatterning and Microscopy of Multifunctional Materials," International Workshop on Materials Genomics, Materials Genome Institute, Shanghai University, Shanghai, China, October 2018.
10. "Emerging Opportunities in Chalcogenide Thermoelectrics: From Multicomponent Systems to Hierarchical Architecture," The 3<sup>rd</sup> Asian Conference on Thermoelectrics & The 5<sup>th</sup> Micro & Nanoscale Heat Transfer and Energy Workshop, Taipei, Taiwan, October 2018.
11. "Theronostic Magnetic Nanostructures (MNS) in Biomedicine," University of Illinois at Chicago, Chicago, IL, September 2018.
12. "Seeing the Invisible: An Introduction to NUANCE Center and SHyNE Resource," University of Chicago, Chicago, IL, August 2018.

13. "Dynamic Electron Microscopy of Nanostructured Materials," Korea Advanced Institute of Science and Technology (KAIST), Daejeon, South Korea, June 2018.
14. "Northwestern Facility Infrastructure: Catalyst for Industrial Research & Partner in Open Innovation," Akishima, Japan, June 2018.
15. "Northwestern Facility Infrastructure: Catalyst for Industrial Research & Partner in Open Innovation," Merck-Millipore, Milwaukee, WI, April 2018.
16. "Research Facilities/Infrastructure: Emerging Perspectives," University of California, Santa Barbara, CA, March 2018.
17. "Teaching 'Old' Materials 'New' Tricks: Nanopatterning and Microscopy of Multifunctional Materials," University of Nebraska-Lincoln, Lincoln, Nebraska, March 2018.
18. "Seeing the Invisible: Interfacial Phenomena in Energy Materials," Indo-US Science and Technology Forum, Kolkatta, India, January 2018.

#### **2017**

19. "Teaching 'Old' Materials 'New' Tricks: Nanopatterning & Microscopy of Multifunctional Materials," Southern University of Science and Technology, Shenzhen, China, October 2017.
20. "Towards Correlative, Multimodal and Adaptive Fluidic-Cell Electron Microscopy," Liquid Phase Electron Microscopy Meeting, Eindhoven, The Netherlands, September 2017.
21. "Theranostic Magnetic Nanostructures (MNS) in Biomedicine," Frontiers in Biomagnetic Particles Meeting, Asheville, NC, June 2017.
22. "Seeing the Invisible: From Waste Heat Conversion to Electrochemical Storage," Washington State University, Pullman, WA, April 2017.
23. "Seeing is Believing: Advanced Electron Microscopy of Dynamic Electrophysical Phenomena," International Conference on Advanced Rechargeable Batteries & allied Materials (ICARBM), Pune, India, March 2017.
24. "Seeing the Invisible: Advanced Electron Microscopy of Energy Materials," Indo-US Science and Technology Forum (IUSSTF), Bangalore, India, March 2017.
25. "Dynamics of Charge and Photon Transport: From Waste Heat Conversion to Electrochemical Storage," Arizona State University, Tempe, AZ, February 2017.
26. "Dynamic Phenomena in Energy Materials: From Waste Heat Conversion to Electrochemical Storage," Pennsylvania State University, State College, PA, February 2017.

#### **2016**

27. "Dynamic Phenomena in Energy Materials: *From Waste Heat Conversion to Electrochemical Storage*," Southern University of Science and Technology of China, Shenzhen, China, December 2016.
28. "'Seeing' the Invisible: From Waste Heat Conversion to Electrochemical Storage," Rice University, Houston, TX, October 2016.
29. "Statics and Dynamics of Energy Materials: *From Waste Heat Conversion to Electrochemical Storage*," University of Southern California, Los Angeles, CA, September 2016.
30. "Temperature-controlled Fluidic-Cell Scanning Electron Microscopy," Microscopy & Microanalysis annual meeting, Columbus, OH, July 2016.
31. "In-situ and Dynamic Microscopy in Materials Research," JEOL, Tokyo, Japan, March 2016.
32. "Infrastructure for Nanotechnology – Greater Chicago and US Midwestern Perspective", FEI, Eindhoven, Netherlands, March 2016.
33. "Advanced Microscopy in Materials Research," FEI, Eindhoven, Netherlands, March 2016.
34. "Emerging Opportunities in Nanotechnology: Hip, Hope or Hype?!" Glenbrook South High School, Glenview, IL, February 2016.

35. "NU-JNC Joint Center on Advanced Materials Research," Indo-US S&T Forum (IUSSTF), New Delhi, India, January 2016.

#### **2015**

36. "Advanced Electron Microscopy in Materials Research," Hitachi Naka Works, Mito, Japan, December 2015.
37. "Science, Technology and Globalization," MRSEC REU/RET Lecture, Northwestern University, Evanston, IL, July 2015.
38. "In-Situ Microscopy of Energy Materials," University of Texas at Austin, Austin, TX, July, 2015.
39. "Facility Infrastructure Strategies," University of Texas at Austin, Austin, TX, July 2015.
40. "From Atoms to Animals: Multimodal Imaging in Cancer Diagnostics and Therapeutics", Cancer Center Symposium Talk, Northwestern University, Evanston, IL, April 2015.
41. "Advanced Materials for Energy," JNCASR, Bangalore, India, March 2015.
42. "Advanced Materials Research – A global collaboration model," Indian Institute of Science (IISc), Bangalore, India, March 2015.
43. "Advances in Electron Microscopy in Materials Science," Nanyang Technological University (NTU), Singapore; February 2015.
44. "In-situ Microscopy of Electrochemical Reactions," IIT Bombay, India, January 2015.
45. "Future Global Collaborations in Energy-related Materials," Faculty Academic Network (FAN) Workshop, Goa, India, January 2015.

#### **2014**

46. "Correlative Microscopy and Characterization: Towards Form-Function Relationship in Biological Systems," Materials Research Society (MRS) Fall Meeting, Boston, MA, December 2014.
47. "In-situ and Ex-situ Electron Microscopy of Energy Materials," University of Connecticut, Storrs, CT, October 2014.
48. "Emerging Nanotechnology," NSERVE, Summer Career Exploration Program, Oakton Community College, Skokie, IL, August 2014.
49. "Strain Mediated Phenomena in Nanostructured Oxides and Chalcogenides," MRS On Demand Webinar Series, Elastic Strain Engineering Live Broadcast, Evanston, IL, May 2014.
50. "Materials for Emerging Energy Paradigm," National Chemical Laboratory (NCL), Pune, India, March 2014.
51. "Advanced Materials Research: Case for Indo-US Collaborative Program," Indo-US Forum (IUSSTF) New Delhi, India, March 2014.
52. "Nano-Bio-Technology in Emerging Biomedicine," ETH Zurich, Zurich, Switzerland, February 2014.
53. "Nano-Bio-Technology in Emerging Biomedicine," University of Basel, Basel, Switzerland, February 2014.
54. "Hierarchical Microstructural Architecture for High-performance Thermoelectrics," TMS RF Mehl Medal Symposium on Frontiers in Nanostructured Materials and Their Applications, 2014 TMS Annual Meeting, San Diego, CA, February 2014.
55. "Magnetic Nanostructure (MNS) Complexes as Theranostic Carriers," IIN-Nanomedicine Workshop, Evanston, IL, February 2014.
56. "Nanotechnology for Energy Conversion and Storage," University of Texas, San Antonio, San Antonio, TX, February 2014.
57. "Nanotechnology for Energy," National Chemical Laboratory (NCL), Pune, India, January 2014.
58. "Global McCormick and Indo-US Collaborative Initiatives," JNCASR, Jakkur, India, January 2014.
59. "Commercial and Business Opportunities in Emerging Nanotechnology," Kothari Group, Chennai, India, January 2014.



60. "Advances in Nano-Bio-Technology," Piramal Life Sciences, Mumbai, India, January 2014.

### **2013**

61. "Strain Mediated Phenomena in Nanostructured Oxides and Chalcogenides," MRS Fall Meeting, Boston, MA, December 2013.
62. "Converting Waste Heat into Electricity: Emergence of High Performance Tailored Nanostructured Thermoelectrics," Center for Nano and Molecular Science, University of Texas, Austin, TX, November 2013.
63. "Theranostic Magnetic Nanostructures (TX-MNS): Combining Non- Invasive Diagnostic Imaging with Targeted and Timed Therapeutic Delivery", Workshop on Targeting and Triggering from Molecules to Materials, University of Massachusetts, Amherst, MA, October 2013.
64. "Nanostructured Thermoelectrics," Nanyang Technical University, Singapore, August 2013.
65. "Bio-Nano-Sensors," Nanyang Technical University, Singapore, August 2013.
66. "Materials and Energy," Indian Institute of Science Global Alumni Meeting, Chicago, IL, July 2013.
67. "Teaching 'Old' Materials 'New' Tricks: Nanopatterning and Microscopy of Multifunctional Materials," Electron Microscopy Society of India (EMSI) annual meeting, Kolkata, India, July 2013.
68. "Nanotechnology," National Chemical Laboratory, Pune, India, June 2013.
69. "Science, Technology, Education & Policy (S.T.E.P.) in the Right Direction for Energy, Environment and Sustainability: Role of Nanoscience and Nanotechnology," 3<sup>rd</sup> International Workshop on Cleanroom Training for Critical and Sustainable Technologies, Bilkent University, Ankara, Turkey, June 2013.
70. "Hierarchical Length-scale Influence in Bulk Nanostructured Thermoelectrics," MRS Spring Meeting, San Francisco, CA, April 2013.
71. "Atomically-layered Structures: Direct Assembly, Defect Structure and Transport Phenomena," MRS Spring Meeting, San Francisco, CA, April 2013.
72. "Emerging Approaches for Nanopatterning of Soft, Hard and Hybrid Structures," SPIE Micro-Nanotechnology Sensors, Systems, and Applications Conference, Baltimore, MD, April 2013.
73. "Emerging Nanotechnology for Biomedicine and Quality of Life: Will 75 Become the New 35?" North Shore Senior Center's Annual Meeting, Northfield, IL January 2013.

### **2012**

74. "Science, Technology, Education and Policy (STEP) in the Right Direction for Energy, Environment and Sustainability: The Role of Nanoscience and Nanotechnology," ICONSAT Hyderabad, India, January 2012.
75. "Business of Energy," Reliance Industry Limited, Mumbai, India, March, 2012.
76. "Business of Energy: Energy, Environment and sustainability: A S.T.E.E.P. Challenge," DOE-COV, Germantown, MD, May 2012.
77. "'Hard' Nanostructures for 'Soft' Biomedicine," Nanyang Technological University, Singapore, May 2012.
78. "Nanotechnology: A Decade Later," Nanyang Technological University, Singapore, May 2012.
79. "High-end Facility Infrastructure for Emerging Materials Research," Bangalore, India, July 2012.
80. "Magnetic Nanostructures in Biomedicine," India, August 2012
81. "Teaching 'Old' Materials 'New' Tricks: Nanopatterning & Microscopy of Multifunctional Materials," Hsuen Lee Award Lecture, Institute for Metals Research (IMR), Shenyang, China, September 2012.
82. "Emerging Electron Microscopy in Nanotechnology Research," Tsinghua University, Beijing, China, September 2012.

### **2011**

83. "Bio-Cryo-Microscopy in Medicine," Keck Foundation Review, Chicago, IL, January 2011.

84. "Magnetic Nanostructures in Biomedicine," IIT Bombay, Bombay, India, February 2011.
  85. "Soft Epitaxy of Multifunctional Oxides," Lawrence Workshop, Arizona State University, Tempe, AZ, February 2011.
  86. "Materials for Energy," Arizona State University, Tempe, AZ, February 2011.
  87. "Nanopatterning of Multifunctional Oxides," University of Texas-San Antonio, San Antonio, TX, March 2011.
  88. "Teaching Old Materials New Tricks: Nanopatterning of Multifunctional Oxides," University of Central Florida, Nanotech Center, Orlando, FL, March 2011.
  89. "Opportunities for Tri-Lateral US-India-Israel Global Initiative," Evanston, IL, March 2011.
  90. "Magnetic Nanostructures for Theranostics Administration of Cancer," Annual ACS Meeting, Anaheim, CA, March 2011.
  91. "Hierarchical Length-scale Influence in Nanostructured Thermoelectrics," USC-DOE Workshop on Energy, Los Angeles, CA, April 2011.
  92. Hierarchical Length-scale Influence in Nanostructured Thermoelectrics," MRS Spring Meeting and Exhibit, San Francisco, CA, April 2011.
  93. "Introduction to NUANCE Center," Nanyang Technological University, Singapore, June 2011.
  94. "Teaching 'Old' Materials 'New' Tricks: Nanopatterning and Microscopy of Multifunctional Materials," International Workshop on Advanced Electron Microscopy and Applications in Materials Science, Shanghai, China, June 2011.
  95. "Nanopatterned Multifunctional Oxides: From Basic Science to Applied Technologies: Collaborative opportunities with the NU NUANCE Center," Oxford University, London Center for Nanotech (LCN), London, England, August 2011.
  96. "Nanopatterning of Functional Oxides; Collaborative Opportunities with the NUANCE Center," JNCASR-NU, India, September 2011.
  97. "Making a Mountain out of Mole Hill: Electron Microscopy of Nanostructured Thermoelectrics," Michigan State University, East Lansing, MI, October 2011.
  98. "MRSEC Shared Facilities Management Workshop", NUANCE Center, Northwestern University, Evanston, IL, November 2011.
  99. "Seeing is Believing: Nanostructures in Alkali Metal Doped Lead Telluride," MRS Fall Meeting, Boston, MA, December 2011.
  100. "Promise of Nanotechnology for Society," London Olympia Convention, London, England, December 2011.
  101. "Emerging Alternative Energy Sources and Policy Considerations," Imperial College London, London, England, December 2011.
- 2010**
102. "Corollary to Archimedes' Levers: Nano-and Microscale Levers for Seeing and Sensing the Invisible," ICONSTAT 2010, Mumbai, India, February 2010.
  103. "Emerging Microscopy and Spectroscopy: A Window to the Nanoworld," ICONSTAT, Mumbai, India, February 2010.
  104. "Magnetic Nanostructures (MNS) in Biomedicine: Role of Size, Shape and Composition," ACS Meeting, San Francisco, CA, March 2010.
  105. "Teaching 'Old' Materials 'New' Tricks: Site- and Shape-specific Nanopatterning of Multifunctional Materials," CNST Annual Nanotechnology Workshop, University of Illinois, Urbana, IL, May 2010.
  106. "Emerging Magnetic Nanostructures for Theranostics," Molecular Imaging & Cancer Symposium, Northwestern University, Evanston, IL, May 2010.
  107. "Advanced Characterization for Nanostructures," Nanyang Technological University, Singapore, June 2010.

108. "Emerging Magnetic Nanostructures (MNS) as Theranostic Agents in Biomedicine," Nanotechnology Characterization Laboratory, National Cancer Institute, Frederick, MD, September 2010.
109. "Nanopatterning of Multifunctional Oxides," Osaka University Workshop, Osaka, Japan, October 2010.
110. "Advanced Characterization of Bio-Nano-structures in Medicine", NCI-CCNE Workshop, Bethesda, MD, November 2010.
111. "Research Universities as Innovation Hubs in 21<sup>st</sup> Century", NSF-Nano2 workshop, Arlington, VA, December 2010
112. "Emerging Theranostic Nanostructures in Biomedicine", Nano-Bio Workshop, University of Miami, Coral Gables, FL, December 2010.
113. "National Nanotechnology Initiative: A Decade Later", London Center for Nanotechnology, London, England, December 2010.

#### **2009**

114. "Science, Technology, Education and Policy (STEP)," Vibrant Gujarat Global Investor's Summit, Gujarat, India, January 2009.
115. "Nanotechnology a Decade Later: Prospective and Prospects," Nanotech Conference: Sanken International Symposium, Osaka, Japan, January 2009.
116. "Teaching 'Old' Dogs 'New' Tricks: Synthesis and Nanopatterning of Multifunctional Oxides," Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bangalore, India, April 2009.
117. "Nanotechnology: Hip, Hope or Hype?" Nanotechnology Town Hall Meeting V, Evanston, IL, May 2009.
118. "Teaching Old Materials New Tricks: Nanopatterning and Localized Properties of Multifunctional Oxides," CNM Nanoscience Colloquium, Argonne National Laboratory, Lemont, IL June 2009.
119. "Synthesis, Patterning and Properties of Nanostructured Oxides," INDO-US Joint Conference on Advanced Materials, Bangalore, India, September 2009.
120. "Development of a Scanning Near-Field Ultrasound Holography (SNFUH) System as a Nano-Metrology Toolset for Buried Defects and Sub-Surface Pattern Recognition," Metrology Webinar, Semiconductor Research Corporation, Durham, NC, September 2009.
121. "Towards Targeted In-Vivo Theranostics with Magnetic Nanostructures," 11<sup>th</sup> International Conference on Advanced Materials (ICAM), Rio de Janeiro, Brazil, September 2009.
122. "Corollary to Archimedes' Levers: Nano- and Microscale Levers for Seeing and Sensing the Invisible," Center for Nanoscale Materials Users Meeting, Materials & Fabrication for Nanoelectromechanical Systems (NEMS) Focus Session, Argonne National Laboratory, Aurora, IL, October 2009.
123. "Nanopatterning of Multifunctional Oxides: Teaching Old Materials New Tricks," DFG-NSF Conference, New York, NY, October 2009.
124. "Nanotechnology and Business: Hype, Hope or Hip?" Brinks Hofer Gilson & Lione and the NanoBusiness Alliance (NBA) Nanotechnology Seminar, Chicago, IL, December 2009.

#### **2008**

125. "Nanopatterning of Ceramics," American Ceramics Society Annual Meeting, Daytona Beach, FL, January 2008.
126. "Nanotechnology in Petrochemicals," Reliance Industries Ltd., Mumbai, India, February 2008.
127. "Emerging Bio-Chem Sensor Platform," Baxter Corporation, Round Lake, IL, April 2008.
128. "Teaching 'Old' Materials 'New' Tricks: Site- and Shape-Specific Nanopatterning of Multifunctional Oxides," Nanoscience and Technology Institute (NSTI), Boston, MA, June 2008.

129. "Emerging Microscopy Techniques for Catalyst Characterization," Institute for Sustainability and Energy, Northwestern University, Evanston, IL, August 2008.
130. "Nanotechnology in Petrochemical Industries: Hip, Hype or Horrible?!" Indian Petrochem, Mumbai, India, November 2008.

#### **2007**

131. "Interdisciplinary Nanomechanics: From Acoustic Imaging to Microcantilever-based BioChemSensing," PittCon Waters Symposium, Chicago, IL, February 2007.
132. "Nanotechnology and Business: Hip, Hype or Horrible?" Reliance Industries, Mumbai, India, February 2007.
133. "Disruptive Technology Opportunities in Nanotechnology," Reliance Industries, Mumbai, India, February 2007.
134. "Emerging Nanostructures and Devices for Nano-Bio-Medicine," Children's Memorial Research Center Academic Day, Chicago, IL, April 2007.
135. "Overview of the NUANCE Center," Centerpiece Live, Evanston, IL, May 2007.
136. "Development of Scanning Near Field Ultrasound Holography (SNFUH) System as a Nano-Metrology Toolset for Buried Defects and Sub-Surface Pattern Recognition," SRC Nanolithography Review, Madison, WI, May 2007.
137. "Teaching Old Materials New Tricks: Site -Shape- Specific Patterning of Functional Nanostructures," University of Albany, Albany, NY, May 2007.
138. "Emerging Nanostructures and Devices for Imaging and Therapeutics," Pfizer Meeting, Evanston, IL, June 2007.
139. "Some Assembly Required: Patterning, Lithography and Functional Identity of Nanostructures," McBain Memorial Lecture, National Chemical Laboratory (NCL), Pune, India, July 2007.
140. "Variable Pressure Soft Electron Beam Lithography (VP-e BL)," Microscopy and Microanalysis 2007, Fort Lauderdale, FL, August 2007.
141. "Some Assembly Required: Self-, Directed- and Hierarchical Patterning and Assembly of Functional Nanostructures," University of Zululand, Richards Bay, South Africa, August 2007.
142. "Appropriate Microscopy at Appropriate Resolution (AMAR)," University of California, Berkeley, CA, September 2007.
143. "Nanotechnology: Hip, Hype or Horrible?!" Illinois Engineering Council, Chicago, IL, October 2007.
144. "Emerging Nanostructures and Devices for Biomedicine," IEEE Sensor Council Symposium, Atlanta, GA, October 29, 2007.
145. "Seeing the Invisible: Holography and Interference Scanning Probe Microscopy in the Nonlinear Regime," DSRC -DARPA Workshop, Arlington, VA, November 7-8, 2007.
146. "Seeing and Sensing the Invisible: Emerging Nanostructures and Devices for Biochemical Imaging, Diagnostics and Therapeutics," University of Washington Seattle, WA, November 2007.
147. "Teaching 'Old' Materials 'New' Tricks: Patterning, Microscopy and Functional Identity of Nanostructures," University of Washington Seattle, WA, November 2007.
148. "Some Assembly Required: Nanopatterning of Multifunctional Materials," Nano 2007 Conference, Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bangalore, India, December 2007.

#### **2006**

149. "Nanopatterning of Functional Inorganics," IED Detection Symposium, Sandia National Laboratory, Albuquerque, NM, January 2006.
150. "Nondestructive Subsurface Analysis with SPM," University of Pennsylvania Nanoprobe Network, Philadelphia, PA, January 2006.

151. "Top Down Meets Bottom Up: Emerging Paradigms in Bio-Chem Nanosensors," IIT Colloquium Series, Chicago, IL, February 2006.
152. "Emerging Microscopy Techniques: Answers Looking for Appropriate Questions," State Microscopical Society of Illinois Meeting, Chicago, IL, February 2006.
153. "Interdisciplinary Nanomechanics: From Acoustic Imaging to Microcantilever-based Bio-Chem Sensing," University of Illinois, Urbana-Champaign, Urbana, IL, February 2006.
154. "Teaching Old Materials New Tricks: Nanopatterning of Functional Inorganics," Iowa State University Colloquium Series, Ames, IA, March 2006.
155. "Teaching Old Materials New Tricks: Nanopatterning of Functional Inorganics," University of Texas, Austin, TX, March 2006.
156. "Nanostructured Devices," Honeywell visit, Minneapolis, MN, March 2006.
157. "Nanomechanics Based Devices for Imaging and Sensing," NSF-Korea Workshop, Seoul, Korea, April 2006.
158. "Emerging Nanostructures and Devices for Novel Diagnostics and Therapeutics," ENH GE meeting, Evanston, IL, June 2006.
159. "Development of Scanning Near-Field Ultrasound Holography (SNFUH) System as a Nano-Metrology Toolset for Buried Defects and Sub-Surface Pattern Recognition," SRC Nanolithography Review, Madison WI, June 2006.
160. "Status and Future of NUANCE Center," DuPont Corp., Wilmington, DE, June 2006.
161. "Electron Microscopy & Spectroscopy," ASME Nano Bootcamp, Minneapolis, MN, July 2006.
162. "Electron Microscopy and Spectroscopy," NSF Short Course, Evanston, IL, August 2006.
163. "Magnetic Nanostructures for Biomedicine," Nano Meeting, Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bangalore, India, August 2006.
164. "Nanopatterning of Inorganics," Nano 2006 Meeting, Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bangalore, India, August 2006.
165. "Nanomechanics in Microelectronics: From Ultrasound Holographic Imaging to MOSFET-Embedded Microcantilevers," Intel Visit, Ronler Acres, OR, September 2006.
166. "Getting More out of the Scanning Probe: From Acoustic Holographic Imaging to Bio-Chem Sensing," Frontiers of Microscopy Workshop, West LaFayette, IN, October 2006.
167. "Emerging Bio-Nano-Structures and Devices for Imaging, Diagnostics and Therapeutics," 1<sup>st</sup> International Symposium of Nano Bio Molecular Assembly, Yonsei University, Seoul Korea, October 2006.
168. "MOSFET-Embedded Microcantilevers," IEEE Sensors 2006 conference, Daegu, South Korea, October 2006.
169. "Emerging Nanostructures and Devices for Imaging, Diagnostics and Therapeutics," TDD Bioimaging Symposium, University of Toronto, Toronto, Ontario, November 2006.
170. "Seeing the Invisible: Scanning Near-Field Ultrasound Holography (SNFUH) for Non-Destructive Nanoscale Imaging of Buried and Embedded Structures," FENA Workshop, San Francisco, CA, December 2006.

## **2005**

171. "Integrating Emerging Bio Nano Structures on Engineering Platform: Bottom Up Meets Top Down," Nanotechnology Workshop Organizer, Bombay, India, January 2005.
172. "Novel Electronic Transduction Scheme for Biomolecular Binding Events," APS Annual Meeting, Los Angeles, CA, March 2005.
173. "High Resolution Near-Field Acoustic Holography (NFAH) of Embedded Nanostructures," ASME Nanotechnology Institute, Knoxville, TN, May 2005.
174. "Advanced Microscopy and Spectroscopy: Window to the Nanoworld," Mornings at McCormick-Northwestern University, Evanston, IL, May 2005.

175. "Advanced Microscopy," ASME Nanobootcamp," Washington, DC, July 2005.
  176. "Scanning Near-Field Ultrasound Holography (SNFUH) for Non-Destructive Nanoscale Imaging of Sub-surface and buried features," Seeing at the Nanoscale III, Veeco Inc, Washington, DC, August 2005.
  177. "Scanning Near-Field Ultrasound Holography (SNFUH) for Non-Destructive Nanoscale Imaging of Sub-surface and buried features," Visit with collaborators at University of Oxford, Oxford, England, August 2005.
  178. "Bio-Chem Nanosensors," University of Buenos Aires, Buenos Aires, Argentina, September 2005.
  179. "Integrated Electronic Detection Approach to Biological Warfare Agents using Cantilever Arrays as Hybrid/Parallel Biomechanical Systems," Materials Science and Technology Conference 2005, Pittsburgh, PA, September 2005.
  180. "Some Assembly Required: Building Nanostructures from the Bottom Up Across Length Scales," NanoCommerce/NanoForum, Chicago, IL, October 2005.
  181. "Nanotechnology Programs at Northwestern: Partner in Leadership," Hitachi Corp, San Francisco, CA, October 2005.
  182. "SNFUH Approach for Nano-Metrology," SRC-NIST Workshop, Washington, DC, December 2005.
- 2004**
183. "Nanopatterning of Oxide Sensor Elements," National Institute of Standards and Technology (NIST), Washington, DC, January 2004.
  184. "Teaching Old Materials New Tricks: Site-and Shape Specific Nanopatterning," DPN Workshop, Florida, January 2004.
  185. "New Paradigms in Bio-Chem Sensing via Nanostructured Materials," Argonne National Laboratory, Lemont, IL, February 2004.
  186. "Teaching Old Materials New Tricks: Site-and Shape Specific Nanopatterning on Inorganics," University of Pennsylvania, Philadelphia, PA, February 2004.
  187. "Bio-Chem Nanosensors," University Buenos Aires, Argentina, March 2004.
  188. "Novel Bio-Nano Sensors," Virginia Commonwealth University, Richmond, VA, March 2004.
  189. "Probing the Invisible: Near Field Acoustic Holography & Towards Novel Paradigms in Nano-bio Sensors," AcerS Annual Meeting, Indianapolis, IN, April 2004.
  190. "Site Specific Nanopatterning of Inorganics," Materials Research Society, Spring 2004 Meeting, San Francisco, CA, April 2004.
  191. "Towards Novel Paradigms in Nano-Bio Sensors," Americas Materials Conference: Chile, US, and Brazil, Santiago, Chile, April 2004.
  192. "N3: Nanotechnology and Nanoscience at Northwestern," Nano-Bio Outreach Workshop, Palo Alto, CA, May 2004.
  193. "Site-specific Nanopatterning of Inorganics: Nanodots and Microcantilevers," Dept Colloquium, University of Wisconsin, Milwaukee, WI, May 2004.
  194. "Emerging Bio-Chem Nanosensors," IMTECH, NCL, Pune, and IIT Bombay, India, July 2004.
  195. "Nanoscale Science, Technology and Educational Initiatives at Northwestern," US-India Nano Workshop, Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bangalore, India, August, 2004.
  196. "NUANCE Center," US-India Nano Workshop, Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bangalore, India, August, 2004.
  197. "To Find a Needle in a Haystack: In-situ Manipulation and Measurements of Nanostructures," CNMS-ORNL, Knoxville, TN, September 2004.
  198. "Nanotechnology Beyond the Hype: Towards High Technology Job Creation and Illinois Leadership," State of Illinois Trade Office Meeting, Chicago, IL, September 2004.

199. "Nanopatterning and Microscopy of Nanostructures," Nanotech Seminar at 3M, Minneapolis, MN, October 2004.
200. "Novel Electronic Transduction Scheme for Biomolecular Binding Events," DARPA/Simbiosys PI Meeting, Vail, CO, October 2004.
201. "Integrating Emerging Bio Nano Structures on Engineering Platform: Bottom UP Meets Top Down," Purdue University, West LaFayette, IN, November 2004.
202. "Probing the Invisible: NFAH," Fall MRS Meeting, Boston MA, November 2004.
203. "Probing the Invisible: Near Field Acoustic Holography," DARPA meeting, NSF-NIH Workshop, Washington, DC, November 2004.
204. "Tuning GB Barrier via Thermal Treatment," Boston, MA, November 2004.
205. "Integrating Emerging Bio Nano Structures on Engineering Platform: Bottom Up Meets Top Down," National Chemical Laboratory, Pune, India, December 2004.

### **2003**

206. "Nanosensors for BCW Agents," Oak Ridge National Laboratory, Oak Ridge, TN, January 2003.
207. "Functional Nanopatterns for Ferroelectrics," Sandia National Laboratory, Albuquerque, NM, March 2003.
208. "Inorganic Nanotstructures for Bio-Chem Sensors," Annual AcerS Mtg, Nashville, TN, May 2003.
209. "Development of Central User Facilities and Multiuser Coordination," Faculty Academic Network Workshop, Palo Alto, CA, June 2003.
210. "Nanotechnology at Northwestern University," University of Buenos Aires, Buenos Aires, Argentina, June 2003.
211. "Towards Electronic Nano-Nose," University of Buenos Aires, Buenos Aires, Argentina, June 2003.
212. "Introduction to NUANCE Center," Veeco Inc., Information Session, Santa Barbara, CA, July 2003.
213. "Nanopatterning of Functional Inorganics," MRSEC Seminar, Santa Barbara, CA, July 2003.
214. "Scanning Acoustic Holography," Veeco Inc., Santa Barbara, CA, July 2003.
215. "Holography and Interference Microscopy," Microscopy Annual Meeting, San Antonio, TX, July 2003.
216. "Site Specific Nanopatterning," Microscopy Annual Meeting, San Antonio, TX, July 2003.
217. "Nanopatterning," Integrated Nanosystems Meeting, Palo Alto, CA, September 2003.
218. "Near Field Holography," SEMATECH, Analytical Manager Meeting, Austin, TX, September 2003.
219. "Nanopatterning of Inorganics," Brazilian Materials Society Bi-Annual Meeting, Rio de Janeiro, Brazil, October 2003.
220. "Emerging Issues in Nanoscience and Nanotechnology," IIT Bombay, India, December 2003.
221. "Advanced Electron Microscopy of Interfaces and Defects," IIT Bombay, India, December 2003.
222. "Site-and Shape Specific Nanopatterning of Ferroelectrics," Annual Materials Research Meeting, Boston, MA, December 2003.
223. "Probing Ferroelectric Domain Dynamics," Annual Materials Research Meeting, Boston, MA, December 2003.
224. "Material Science and Integration of a New Hybrid TiAl- Layer," Annual Materials Research Meeting, Boston, MA, December 2003.
225. "Miniaturized Electronic Nano-Nose," Annual Materials Research Meeting, Boston, December 2003.

### **2002**

226. "Teaching Old Ceramics New Tricks: Site-Specific Nanopatterning of Functional Inorganics," Gordon Research Conference, Meriden, NH, August 2002.
227. "Nanotitration of Active Grain Boundaries," Electroceramics VIII conference, Rome, Italy, August 2002.
228. "Electron Holography in Materials Science," International Conference on Electron Microscopy, Durban, South Africa, September 2002.
229. "Better Transparency and Conductivity through ALCHEMI," International Conference On Electron Microscopy, Durban, South Africa, September 2002.
230. "Site- and Shape-Specific Nanopatterning of Ceramics," Colloquium, University of Illinois at Urbana-Champaign, Urbana, IL, September 2002.
231. "Nanopatterning of Addressable Functional Inorganic Nanostructures," PASI, Joint Argentina-NSF workshop on Ferroelectrics, Rosario, Argentina, September 2002.
232. "3-D Nanomanipulation in TEM for Nanostructures," ASME Annual Meeting, New Orleans, LA, November 2002.
233. "Nanopatterning of Functional Inorganics," IBM Watson, Yorktown Heights, NY, November 2002.
234. "Nanostructures for Functional Duties," International Conference on Inorganic Materials, IIT Bombay, India, December 2002.
235. "Site-and Target specific Drug Delivery Approaches," International Conference on Inorganic Materials, IIT Bombay, India, December 2002.
236. "Nanopatterning," Annual MRS Meeting, Boston, MA, December 2002.

#### **2001**

237. "Advanced Electron Microscopy in Materials Research at Northwestern University," Nissei Sangyo America, Mountain View, CA, January 2001.
238. "Patterning Magnetic Nanostructures," DPN Workshop, Key West, FL, February, 2001.
239. "Synthesis, Characterization and Patterning of Soft and Hybrid Nanostructures," National Institutes of Health (NIH), Bioengineering Seminar, Bethesda, MD, February 2001.
240. "Electron Holography of Active Structures," University of Oslo Workshop on Advanced Electron Microscopy, Oslo, Norway, March 2001.
241. "Hierarchical Length-Scale Influence on Interfacial Phenomena," MSE Seminar, Lehigh University, Bethlehem, PA, May 2001.
242. "Probing the Invisible: Electron Holography of Electrically Active Interfaces," First European Workshop on Electron Holography, Stockholm, Sweden, June 2001.
243. "In-situ Electron Holography of Active Nanostructures," Workshop on In-Situ EM, National Center for Electron Microscopy, Berkeley, CA, June 2001.
244. "When Electrons Meet Light: Advanced EM of Optical Active Oxides," NU-CNRS Workshop, Evanston, IL, June 2001.
245. "Focused Ion Beam: More than just a fancy IBT," Microscopy and Microanalysis' 2001, Long Beach, CA, August 2001.
246. "When Electrons Meet Light: ALCHEMI of Optical Active Oxides," Microscopy and Microanalysis' 2001, Long Beach, CA, August 2001.
247. "Towards Predictive Structure-Property Relationship for Electrically Active Interfaces," RPI, Materials Science Colloquium, Troy, NY, September 2001.
248. "Synthesis, Patterning and Microscopy of Nanostructures," University of Connecticut, Mansfield, CT, October 2001.
249. "Development and Management of Shared User Facilities," MRSEC Director's Meeting, Brown University, Providence, RI, November, 2001.



250. "Microscopy for Nanotechnology and Vice Versa," IIT Bombay, India, December, 2001.

#### **2000**

251. "How Low Can One Get? Low Voltage Imaging and Spectroscopy with FEG SEM," MAS NY Chapter, MAS Tour Speaker Event, Fishkill, NY, February 2000.

252. "Low Voltage Imaging, Diffraction and Spectroscopy," General Electric, Central R & D, Schenectady, NY, March 2000.

253. "Dynamics of Charged Interfaces in Dielectric and Ferroelectric Thin Films," International Conference of the International Society for Integrated Ferroelectrics (ISIF-00), Aachen, Germany, March 2000.

254. "Probing the Invisible: Electron Microscopy of Nanostructures," Physics and Nanotechnology Initiative, University of Central Florida, Orlando, FL, March 2000.

255. "Towards Structure-Property Relationship for Electroceramic Interfaces," Lehigh University, Bethlehem, PA, March 2000.

256. "Graphite Encapsulated Magnetic (GEM) Nanocrystal: Carriers for Site-Specific Drug Delivery?!" Robert H. Lurie Comprehensive Cancer Center, Evanston, IL, March 2000.

257. "Teaching Old Nanostructures New Tricks," MSE Colloquium, Northwestern University, Evanston, IL, October 2000.

258. "Dynamics of Electrically Active Interfaces," Korea Advanced Institute for Science and Technology, (KAIST), Daejeon, South Korea, October 2000.

259. "Electron Holography and Spectroscopy of Interfaces," Keynote Address, Annual Meeting of the Korean Ceramic Society, Chunchun, South Korea, October 2000.

#### **1999**

260. "Engineering First: Integrating Basic Sciences and Mathematics in Engineering Curricula," IIT Bombay, India, March 1999.

261. "Advanced Electron Microscopy of Nanostructures," Tata Institute for Fundamental Research, Bombay, India, March 1999.

262. "In-Situ Dynamic Studies of Electrically Active Interfaces," MRS Spring Meeting, San Francisco, CA, April 1999.

263. "Electron Holography of Active Interfaces," Annual Meeting of the American Ceramic Society, Indianapolis, IN, April 1999.

264. "Probing the Invisible: Electron Spectroscopy and Holography of Electrically Charged Interfaces." Georgia Tech, Atlanta, GA, May 1999.

265. "Electron Holography of Active Junctions," IBM Watson Research Center, Yorktown Heights, NY, July 1999.

266. "Probing Electrically Active Interfaces," Bell Labs, Lucent Technologies, Murray Hill, NJ, July 1999.

267. "Dynamics of Grain Boundary Space-Charge Potential in Electroceramics," Microscopy and Microanalysis 99, Portland, OR, August 1999.

268. "Analytical Electron Microscopy of Composite Interfaces," Microscopy and Microanalysis 99, Portland, OR, August 1999.

269. "Hierarchy of Length-Scales in Crack Propagation and Fracture," NIST/CRC Invitee Workshop, Gaithersburg, MD, September 1999.

270. "Electron Holography of Active Structures," SEMATECH, Austin, TX, October 1999.

271. "Dynamics of Charged Interfaces via Electron Holography," Motorola, Austin, TX, October 1999.

272. "Electron Holography of Charged Interfaces," Applied Micro Devices, Sunnyvale, CA, November 1999.

273. "Dynamics of Electrically Active Interfaces," MRS Fall Meeting, Boston, MA, November/December 1999.

**1998**

274. "Analytical Electron Microscopy in Materials Science," Naka Works, Hitachi Corporation, Ibaraki, Japan, January 1998.

275. "Electron Probe Instrumentation Center (EPIC)," Advanced Research Laboratory, Hitachi Corporation, Japan, January 1998.

276. "Statics and Dynamics of Interfaces in Electroceramics," US-Japan Workshop on Electrically Charged Interfaces, MIT, Cambridge, MA, March 1998.

277. "In-Situ TEM Studies of Domain Switching Dynamics in Ferroelectric Thin Films," Int. Symp. on Ferroic Domains and Mesoscopic Structures (ISFD-5), Penn State University, University Park, PA, April 1998.

278. "Dynamic TEM of Interfaces and Defects," Ann. Mtg. Ohio Chapter of the AVS, Cleveland, OH, June 1998.

279. "Spectroscopy of Oxide Superconductors," CNRS Workshop on Emerging Issues in HTS, Caen, France, July 1998.

280. "Statics and Dynamics of "Charged" Interfaces in Electroceramics," Microscopy and Microanalysis 98, Atlanta, GA, July 1998.

281. "Anisotropy of Electron Structure and Transport Properties of Oxide Superconductors," Microscopy and Microanalysis 98, Atlanta, GA, July 1998.

282. "Seeing Invisible: Electron Spectroscopy and Holography of Electrically Active Interfaces," Gordon Research Conference, Solid State Studies in Ceramics, Meriden, NH, August 1998.

283. "Transmission Electron Microscopy, Spectroscopy and Holography of Nanostructured Materials," International Conference on Electron Microscopy (ICEM-98), Cancun, Mexico, September 1998.

284. "Probing the Invisible at Electrically Active Interfaces," Cal Tech, Pasadena, CA, October 1998.

285. "Electron Microscopy of Nanostructured Materials," Plenary Lecture, Bi-annual Meeting of the Brazilian Society for Electron Microscopy, Brazil, October 1998.

286. "Analytical Electron Microscopy of Interfaces," Keynote Lecture, Bi-annual Meeting of the Brazilian Society for Electron Microscopy, Brazil, October 1998.

**1997**

287. "AEM of Interfaces," Arizona State University, Tempe, AZ, January 1997.

288. "Crack Propagation in DSEs: Experimental and Simulations," NIST, Gaithersburg, MD, January 1997.

289. "Electrically Active Interfaces in Ceramics," Case Western Reserve University, Cleveland, OH, February 1997.

290. "Interfaces in DSE's of Oxides," Wright-Patterson Air Force Laboratories, Dayton, OH, March 1997.

291. "Introduction to Scanning Microscopy," Annual Meeting of Scanning Microscopy, Chicago, IL, May 1997.

292. "Valence Band EELS," Annual Meeting of Scanning Microscopy, Chicago, IL, May 1997.

293. "Electron Spectroscopy and Holography of Interfaces," Microscopy Society of America Annual Meeting, Cleveland, OH, August 1997.

294. "EBSD in a Cold FEG SEM," Microscopy Society of America Annual Meeting, Cleveland, OH, August 1997.

295. "Statics and Dynamics of Electroceramics," University of Illinois at Urbana-Champaign, Urbana, IL, September 1997.
296. "Hierarchy of Length-Scale Influence in Crack Propagation in Oxide Composites," ASM/TMS Special Symposium, Indianapolis, IN, September 1997.
297. "Interfaces in Electroceramics," MSE Colloquium, Carnegie Mellon University, Pittsburgh, PA, September 1997.
298. "In-Situ Electron Microscopy," Annual Meeting of MRS, Boston, MA, November, 1997.
299. "Dynamics of Electrically Active Interfaces," MRS Annual Meeting, Boston, MA, November 1997.
300. "Seeing the Invisible: Electron Holography of Charged Interfaces," Cavendish Laboratory, Cambridge University, Cambridge, England, December 1997.
301. "Analytical Electron Microscopy in Materials Science," Indian Institute of Science, Bangalore, India, December 1997.

#### **1996**

302. "Length-Scales and Structure-Property Relationships for Internal Interfaces in Oxides," High Temperature Materials Laboratory (HTML), Oak Ridge National Laboratory (ORNL), Oak Ridge, TN, February 1996.
303. "Advanced Electron Microscopy of Interfaces and Interfacial Phenomena in Oxides," University of Wisconsin, Milwaukee, WI, April 1996.
304. "Electron Spectroscopy and Holography of Oxide Interfaces," Frontiers of Electron Microscopy in Materials Science, Oak Brook, IL, June 1996.
305. "Sensitivity and Resolution in EBSD/OIM with a cFEG SEM," Frontiers of Electron Microscopy in Materials Science, Oak Brook, IL, June 1996.
306. "EBSD/OIM with cFEG SEM: Yes it is possible!" Microscopy Society of America, Minneapolis, MN, August, 1996.

#### **1995**

307. "Electroceramic Interfaces," IBM T.J. Watson Research Center, NY, February 1995.
308. "Direct Determination of Structure-Property Relationship for Functional Electroceramic Interfaces," Argonne National Laboratory (ANL), Lemont, IL, March 1995.
309. "High Spatial Resolution Spectroscopy of Internal Interfaces," Max Planck Institute Invited Workshop, Ringberg Castle, Germany, April 1995.
310. "Microanalysis at High Spatial Resolution across Internal Interfaces," Microscopy Society of America Annual Meeting, Cincinnati, August 1995.
311. "Direct Determination of Spatially Varying Potential and Charge across Electroceramic Interfaces," Gordon Research Conference on Solid State Studies in Ceramics, Meriden, NH, August 1995.

#### **1994**

312. "Microscopy and Spectroscopy of Ionic Interfaces," Invited Workshop on Ionic Interfaces, Max-Planck Institute, Ringberg Castle, Germany, March 1994.
313. "Dielectric Function and Electronic Structure of Oxide Superconductors." Bhabha Atomic Research Center (BARC) Bombay, India, March 1994.
314. "Synthesis, Characterization and Properties of Buckytubes," Annual Electrochemical Society Meeting, San Francisco, CA, May 1994.
315. "Transmission EELS in Materials Science," EELSI-94 Invited Conference, Leukerbad, Switzerland, July 1994.

316. "Electron Spectroscopy and Interferometry of Electronic Ceramics," Microscopy Society of America, New Orleans, LA, July 1994.
317. "Electron Interferometry and Holography of Real Materials," First International Conference on Electron Holography, Knoxville, TN, August 1994.
318. "Analytical Electron Microscopy in Ceramics Science," Materials Science & Engineering Seminar Series, University of Illinois--Urbana-Champaign, Urbana, IL, October 1994.
319. "Electron Spectroscopy and Holography of Electroceramic Interfaces," MRS Fall Meeting, Boston, MA, November 1994.
320. "Towards Structure-Property Relationship for Electroceramic Interfaces," NIST, Gaithersburg, MD, December 1994.
321. "Interphase Interfaces in Structural Eutectics," General Electric, Corporate R & D, Schenectady, NY, December 1994.

### **1993**

322. "Atomic Structure of Interphase Interfaces in Oxides," Cornell University, Ithaca, NY, September 1993.
323. "Bicrystallography and Plan-View CBED," MSA (EMSA) 93, Cincinnati, OH, August 1993.
324. "Electron Spectroscopy of Internal Interfaces in Ceramics: A Status Update and Forecast," MSA (EMSA) 93, Cincinnati, OH, August 1993.
325. "Electron Holography of Internal Interfaces in Electroceramics: Fact or Fiction?" MSA (EMSA) 93, Cincinnati, OH, August 1993.
326. "Artifacts in AEM of Interfaces: From Specimen Preparation to Data Analysis," Great Lakes EM Society Association (GLEMA), Indianapolis, October 1993.
327. "Analytical Electron Microscopy in Catalysis Research," Amoco R & D, Naperville, IL, July 1993.

### **1992**

328. "High Spatial and Energy Resolution EELS with the HF-2000 ARAEM." First ORNL/UT Workshop on Coherent Beam Electron Microscopy, Knoxville, TN, June 1992.
329. "Atomic Resolution Analytical Electron Microscopy and Electron Holography: Implications for Materials Science," Laboratoire de Chimie des Solides, Universite de Paris-Sud, Orsay, FRANCE, July 1992.
330. "High Spatial and Energy Resolution Analytical Electron Microscopy," First International Symposium on Quantitative Electron Microscopy, National Center for Electron Microscopy, Lawrence Berkeley Laboratory, Berkeley, CA, August 1992.
331. "Space-Group Determination by CBED: G-M Lines, Crosses and HOLZ Interactions," EMSA Annual Meeting, Boston, MA, August 1992.
332. "Determination of Electronic Structure of Oxides by EELS," Workshop on Grain Boundaries in High Tc Superconductors, University of Wisconsin-Madison, Madison, WI, September 1992.
333. "Role of ARAEM in Interface Analysis of High Technology Materials," Wright-Patterson Air Force Laboratory, Dayton, OH, October, 1992.
334. "Electrons' Eyeview of Bucky-Balls, Tubes, Toroids and Whatever Comes Next," ASM/TMS Annual Meeting, Chicago, IL, Nov. 1992.
335. "A Journey into the Nanoworld of Buckytubes and Friends," MRS Annual Meeting, Boston, MA, November 1992.

### **1991**

336. "Progress in Analytical Electron Microscopy of Materials," Argonne National Laboratory (ANL), Lemont, IL, March 1991.

- 337.** "High Resolution and Analytical TEM Studies of Relaxation of Interfaces in Directionally Solidified Eutectics," Center for Solid State Science, Arizona State University, Tempe, AZ, July 1991.
- 338.** "Electron Microscopy Research at Northwestern University," Mid-West Society of Electron Microscopists Annual Meeting, Chicago, IL, May 1991.
- 339.** "Transmission EELS of Hole Formation and Charge Transfer in Oxide Superconductors," Bulk Properties and Critical Currents in Oxide Superconductors Symposia, Argonne National Laboratory (ANL), Lemont, IL, March 1991.