KATAYUN (KATY) BARMAK

Department of Applied Physics and Applied Mathematics
Columbia University
500 West 120th Street, Suite 200
New York, NY 10027
Tel: (212) 854-8267
E-mail: kb2612@columbia.edu
URL: https://apam.columbia.edu/katayun-barmak

EDUCATION

Ph.D., Materials Science, Massachusetts Institute of Technology, 1989
M.A., University of Cambridge, England, 1987
S.M., Metallurgy, Massachusetts Institute of Technology, 1985
B.A., Materials Science, 1st Class Honours, University of Cambridge, England, 1983

PROFESSIONAL EXPERIENCE

2013-19	Director, Materials Science and Engineering Program, Department of Applied Physics and Applied Mathematics, Columbia University
2011-	Philips Electronics Professor of Applied Physics and Applied Mathematics and Materials Science and Engineering, Columbia University
2002-11	Full Professor with indefinite tenure, Carnegie Mellon University
1999-02	Associate Professor with indefinite tenure, Carnegie Mellon University
1998-03	Visiting Scientist, IBM T.J. Watson Research Center
1997-98	Associate Professor with indefinite tenure, Lehigh University
1995-98	Co-director, Thin Film Laboratory, Materials Research Center, Lehigh
1992-93	Harold Chambers Junior Faculty Chair of Materials Sci. and Eng., Lehigh
1992-97	Assistant Professor, Lehigh University
1989-92	Staff Engineer, Advanced Device Development, IBM T. J. Watson Research Center and IBM East Fishkill, New York. R&D of materials, processes and structures for advanced generations of bipolar junction and field effect transistors

HONORS AND AWARDS

2023	Fellow, ASM International Citation: *"For seminal contributions to the study of solid-state reactions, phase transformations, microstructure evolution and structure-property relations in metallic films for electronic and magnetic applications."*
2019	IEEE Senior Member
2004	IBM Materials Research Community Visiting Scientist, IBM T. J. Watson Research Center (one of only two faculty awards made worldwide)
1998-03	Visiting Scientist, IBM T.J. Watson Research Center
2001	NSF Creativity Award

1999 IBM Faculty Fellowship Award
1994 National Young Investigator (NYI) Award, National Science Foundation
1994 Deutsche Forschungsgemeinschaft Fellowship Award
1986-89 AT&T Foundation Fellowship Award

UNIVERSITY AWARDS

2017 Edward and Carole Kim Faculty Involvement Award, School of Engineering, Columbia University
To honor a faculty member who is not only an excellent teacher, but who also shows a special, personal commitment to students.

2009 Philbrook Prize in Engineering, Carnegie Mellon University
Awarded for substantial, sustained contributions to excellence in education, or to the application of materials science to important problems.

1995 Alfred Noble Robinson Award, Lehigh University
Awarded for outstanding performance in the service of the university and unusual promise of professional achievement. One given per year.

1992 Chambers Junior Professorship, Lehigh University
An endowed professorship conferred by Lehigh University. One given per year.

PROFESSIONAL SOCIETY BOARD

1998-00 Materials Research Society Council (Equivalent to Board of Directors)

MEMBERSHIP OF PROFESSIONAL SOCIETIES

ASM International (ASM), The Minerals, Metals, Materials Society (TMS); Materials Research Society (MRS); Microscopy Society of America (MSA); Microbeam Analysis Society (MAS); American Physical Society (APS), American Vacuum Society (AVS), Society for Industrial and Applied Mathematics (SIAM), Electrochemical Society (ECS), IEEE, American Association for the Advancement of Science (AAAS), Sigma Xi.

EDITORSHIP, EDITORIAL BOARD, EDITORIAL COMITTEE

2024-27 Editorial Oversight Committee, Journal of Electronic Materials
2017-19 Member of Editorial Board of Journal Magnetism and Magnetic Materials
2010-13 International Materials Reviews Committee
Jointly published by ASM International and the Institute of Materials, Minerals and Mining (UK), *International Materials Reviews* covers technologies affecting the metals, structural ceramics, composite materials and electronic materials industries. Topics range from actual usage to theory and practice of extraction, production, fabrication, properties and behavior of materials
2007-13 Associate Editor, Journal of Electronic Materials (a TMS Society Publication)

CONFERENCE ORGANIZATION

2016 Meeting co-Chair, 13th Joint Magnetism and Magnetic Materials and Intermag Conference, San Diego, CA, 2016
Atsufumi Hirohata, co-Chair; Bruce Gurney, General Chair

1999 Meeting Chair, Materials Research Society Conference, San Francisco, CA, 1999
James S. Speck, Raymond T. Tung, Paul D. Calvert, co-Chairs

SYMPOSIA ORGANIZATION

2020 Polycrystalline Microstructures: Recent Advances and New Trends
Society of Industrial and Applied Mathematics (SIAM) Math and Materials Conference Bilbao, Spain, 2020. Conference held online May 17-28, 2021 as a result of the COVID-19 pandemic.
Katayun Barmak, Yekaterina Epshteyn (Dept. Mathematics, Univ. Utah), Co-Organizers

2020 Recent Developments in Polycrystalline Microstructures
Joint conference of the World Congress on Computational Mechanics and European Community on computational methods in Applied Sciences (WCCM-ECOMAS) Paris, France, 2020, Conference held online Jan. 11-15, 2021 as a result of the COVID-19 pandemic.
Katayun Barmak, Yekaterina Epshteyn (Dept. Mathematics, Univ. Utah), Co-Organizers

1997 Materials Research Society Symposium M: Magnetic Ultrathin Films, Multilayers and Surfaces, San Francisco, CA
Katayun. Barmak, David Chambliss, David Kubinski, Peter. Dederichs, Wim de Jonge, Toshikazu Katayama, Alain Schuhl, James Tobin, Co-Organizers

1994 Materials Research Society Symposium H: Polycrystalline Thin Films: Structure, Texture, Properties and Applications, San Francisco, CA
Katayun. Barmak, Michael. A. Parker, Jerrold. A. Floro, Robert. Sinclair, David. A. Smith, Co-Organizers

CONFERENCE ORGANIZATION COMMITTEES

2020 Organizing Committee Member, SIAM Math and Materials Conference
2014 Program Committee Member, Magnetism and Magnetic Materials Conference
2013 Program Committee Member, Magnetism and Magnetic Materials Conference
2011 Program Committee Member, Magnetism and Magnetic Materials Conference
2008 Program Committee Member, Magnetism and Magnetic Materials Conference
2007 Program Committee Member, Magnetism and Magnetic Materials Conference
2006 Program Committee Member, 10th Joint Magnetism and Magnetic Materials and Intermag Conference
2005 Program Committee Member, 50th Annual Conference on Magnetism and Magnetic Materials
1994-99 International Advisory Committee Member for Functionally Graded Materials

PROFESSIONAL SOCIETY COMMITTEES

2024-26 Fellows Selection Committee, ASM
2023-25 Gold Medal Award Selection Committee, ASM
2023-25 Sauveur Award Selection Committee, ASM
2023-24 Vice Chair, Executive Committee, ASM NY-NJ Chapter
2022-23 Member, Executive Committee, ASM NY-NJ Chapter
2014-17 Elected Member, IEEE Magnetics Administrative Committee (AdCom)
AdCom is responsible for the operations of the Society. It provides administrative support for those who directly manage Society activities.
2011-13 Non-voting Member, IEEE Magnetics Administrative Committee (AdCom)
2011-13 Member, IEEE Magnetics Society and the society representative to Women in Engineering (WIE) Committee.
WIE is a committee of the IEEE Board of Directors
2003-05 Member, Graduate Student Award Subcommittee of the Awards Committee, Materials Research Society
2001 Member, Nominations Committee, Materials Research Society
1998-00 Member, Student Affairs Committee, The Minerals, Metals, Materials Society
1996-98 Chair, Membership Committee, Materials Research Society
1994-95 Chair, Promotion and Retention Subcommittee of the Membership Committee, Materials Research Society

RESEARCH INTERESTS

Synthesis, processing, properties, crystal structure, grain structure, and texture of metallic films for electronic and magnetic applications; thermodynamics and kinetics of solid-state reactions and phase transformations in nanostructured films. Grain boundaries, grain growth and microstructural evolution. Synthesis, characterization and defect computations of transition metal dichalcogenides for electronic, photonic and optoelectronic applications. Characterization techniques of interest include differential scanning calorimetry (DSC), X-ray and electron diffraction (XRD, ED), X-ray reflectivity, electron microscopy (SEM, TEM, S/TEM) and crystal orientation mapping.

RESEARCH PROGRAM FUNDING

63. Co-PI, “Understanding the role of point defects in transition metal dichalcogenide nanoscale devices”, ONR, $185,209 (9/1/2025-8/31/2028) Co-PI: J. Hone, PI: D. Rhodes (U. Wisconsin)

62. PI, “Ballistic conduction in metals for metrology”, AFOSR, $108,318/$444,920 (4/1/2022-3/31/2026). Co-PI: K. Coffey, W. Kaden (U. Central Florida)

61. Co-PI, “Comprehensive minimally/non-invasive multifaceted assessment of nano-/microelectronic devices (CoMMAND)”, AFOSR MURI, $656,382/$7,500,000 (5/1/2022-4/30/2027). PI: P. Prasad, Univ. Buffalo.

60. Co-PI, “Ultraclean transfer of CVD-grown graphene and large-scale graphite crystals”, $150,000, NIST 60NANB21D178 (9/1/2021-8/31/2022). PI: J. Hone.

59. PI, “Collaborative Research: DMREF: Microstructure by Design: Integrating Grain Growth Experiments, Data Analytics, Simulation, and Theory”, NSF DMS 2118206, $724,628/$1,798,855 (9/1/2021-8/31/2025), co-PI: Y. Epshteyn (Univ. of Utah), C. Liu (Illinois Inst. of Technol.), J. Rickman (Lehigh Univ.). Supplemental Funding $50,000 (9/1/2022-8/31/2024).

58. Senior Personnel, “Howard-Columbia Partnership for Research and Education in Superatomic and 2D Materials (PRES2M), NSF DMR2122151, $800,000 (8/15/2021-7/30/2024). PI: T. Searles (Formerly Howard University, joined UIUC in July 2021).

57. Co-PI, “Columbia University MRSEC on Precision-Assembled Quantum Materials”, NSF DMR 2011738, $14,731,713 (9/1/2020 -8/31/2026), PI: J. Hone.

56. Co-PI, Collaborative Research: Towards a Predictive Theory of Microstructure Evolution in Polycrystalline Materials, NSF DMS and DMR $450,000/$700,000 (9/1/2019-8/31/2024). PI: Y. Epshteyn, University of Utah.

55. PI, “Thermoelectric Phenomena in Quasi-One-Dimensional Metals, AFOSR FA9550-18-1-0063 and FA9550-19-1-0156, $291 (12/15/2017-09/30/2021), Co-PI: K. R. Coffey, E. Mucciolo, P. Schelling (Univ. of Central Florida).

54. PI, “Energy Efficient Computing: From Devices to Architecture (E2CDA): Type I: Collaborative Research: Interconnects Beyond Cu”, NSF ECCS 1704270 and SRC 2764.001-004, $393,253/$999,999 (9/1/2017-8/31/2022). Co-PI: A. West, C. V. Thompson (MIT), D. Gall (RPI), K. R. Coffey, W. Kaden, T. Jiang, E. Mucciolo, P. Schelling (Univ. of Central Florida).

53. Co-PI, “SuSCheM: Environmentally Sustainable Pathways for Extracting Valuable Elements from Electronic Wastes, NSF CBET 1706905, $300,000 (9/1/2017-8/31/2020), PI: A. Park, Co-PI: A. West.

52. PI, “Materials and Structures for Pressure Sensors”, Kulite Inc., $151,884 (9/1/2017-8/31/2020). Co-PI: I. C. Noyan.

51. PI, “Materials and Structures for Pressure Sensors”, Kulite Inc., $132,207 (9/1/2016-8/31/2017). Co-PI: I. C. Noyan.

50. Co-PI, “Precision Assembly of Superstratic and Superatomic Solids”, NSF DMR-1420634 MRSEC, $98,000 (7/1/2018-6/30/2019), $86,800 (7/1/2017-6/30/2018), $141,901 (7/1/2016-6/30/2017), $67,700 (7/1/2015-6/30/2016) PI: James Hone.

49. PI, Silicon Valley Community Foundation, unrestricted gift, $25,000 (11/16/2016).

48. PI, LAM Research Corporation, unrestricted gift, $40,000 (6/9/2014).

47. Co-PI, "Epitaxial Growth of Metallic Conductors for Deeply Scaled Interconnects", Semiconductor Research Corporation 2581.001, $27,149 (12/1/2014-6/30/2016), PI: K. R. Coffey, Co-PI: P. Schelling (UCF), SRC 2580.001, $97,730 (12/1/2014-1/31/2017).

46. PI, REU Supplement, Collaborative Research: Towards Rare-Earth-Free Advanced Permanent Magnets – High-Anisotropy $L1_0$ Materials", NSF CMMI-1259736, $10,000 (04/14/2014-08/31/2014).

45. Co-PI, "Ultrathin Intermetallic Phases for Giant Spin Hall Effect", NSF DMR-1411160, $419,994, (9/1/2014-8/31/2017). PI: William Bailey.

44. Co-PI, "Co, Ni, Ru and W as Alternate Interconnects for sub-30 nm Linewidths", Global Research Corporation/Semiconductor Research Corporation, TEL Customization funding, SRC 2323.001, $271,000 (7/1/12-12/31/14). Co-PI: Kevin R. Coffey (UCF).

43. Co-PI: "Oriented, single-crystal nanowires for interconnects: A theoretical investigation", Semiconductor Research Corporation 2361.001, $0/$40,000 (10/1/12-12/31/14). PI: Patrick Schelling, Co-PI: Kevin R. Coffey (UCF).

42. Co-PI, "Multiscale Development of $L1_0$ Materials for Rare-Earth-Free Permanent Magnets", ARPA-E REACT Grant # 0472-1537, $245,000/2,800,000 (11/1/11-09/30/2013). PI: Laura H. Lewis (NEU), other Co-PIs: Vincent Harris (NEU), Jeffrey E. Shield, Ralph. Skomski (UNL), Joseph. Goldstein (UMass, Amherst), Frederick Pinkerton (GM), Steven Constandinidis (Arnold Magnetics)

41. Co-PI: Collaborative Research: Towards Rare-Earth-Free Advanced Permanent Magnets – High-Anisotropy $L1_0$ Materials", NSF CMMI-1129313, $159,041/465,900 (9/1/11-8/31/14). Co-PIs: Laura. H. Lewis (NEU), Jeffrey E. Shield (UNL).

40. PI, "High Throughput Electron and X-ray Diffraction Based Metrology of Nanocrystalline Materials", Global Research Corporation/Semiconductor Research Corporation, SRC 2121.001, $300,000 (2/1/11-1/31/14). Co-PI: Kevin R. Coffey (UCF).

39. PI, "Quantitative Kinetic Experiments and Models of $L1_0$ Formation in FePt, CoPt and Related Alloy Films", Information Storage Industry Consortium, Extremely High Density Recording Program, $35,000 (1/1/10-12/31/10), $17,500 (1/1/11-5/31/11).

38. Co-PI, **"**Electron Microscopy of Hard Coatings and Other Tool Materials", Kennametal Inc., $164,000 (02/01/09-01/31/11). PI: Paul Salvador (CMU).

37. PI, "Automated, Quantitative Microstructural Characterization of Nanometric Metals", Intel, $28,000 (2/1/09-12/31/09).

36. PI, "The A1 to $L1_0$ Transformation in FePt Films with Ternary Alloying Additions", NSF DMR-0804765, $330,000 (7/1/08-6/30/12).

35. PI, "Thermodynamics and Kinetics of the A1 to $L1_0$ Transformation in FePt and Related Ternary Alloys for Ultrahigh Density (1 Tb/in^2) Magnetic Recording Media: Differential Scanning Calorimetry", Seagate Technology/DSSC, $68,000 (01/01/08-12/31/08).

34. Co-PI, "Ordered Intermetallics for Ultrahigh Density Hard Disk Drives (HDD) and for Microelectromechanical Systems (MEMS)", PITA, $23,898 (09/01/06-05/31/08). Co-PI: Gary Fedder (CMU).

33. Co-PI, **"**Electron Microscopy of Hard Coatings and Other Tool Materials", Kennametal Inc., $140,000 (8/1/06-7/31/08). Co-PI: P. Salvador (CMU).

32. PI, "Thermodynamics and Kinetics of the A1 to $L1_0$ Transformation in FePt and Related Ternary Alloys for Ultrahigh Density (1 Tb/in^2) Magnetic Recording Media: Differential Scanning Calorimetry", Seagate Technology, $79,792 (09/01/06-08/31/07).

31. PI, "Resistivity of Cu Interconnects: Grain Growth in Films and Lines", Intel, $70,000, (7/1/06-6/31/08).

30. Co-PI, "Reaction Kinetics of Nickel with Pb-free Sn-Bi-In-Zn-Sb Solders", US CRDF, $75,900 (of which $15,180 is Subcontract to CMU) (03/01/06-02/29/08). PI: Vasyl Dybkov, Institute for Problems of Materials Science, Kyiv, Ukraine.

29. Co-PI, "Carnegie Mellon Materials Research Science and Engineering Center", NSF DMR-0520425, $6,500,000 (9/1/05-8/31/11). PI: Gregory S. Rohrer (UCF).

28. PI, "The A1 to $L1_0$ Transformation in FePt, CoPt and Related Ternary Alloy Films", NSF DMR-0506374, $285,000 (7/1/05-6/30/08).

27. Co-PI, "Electrical Resistivity of Sub-45nm Interconnects: The Classical Size Effect", Semiconductor Research Corporation Task 1212.008, $330,000 ($154,153 Subcontract CMU) (02/01/05-01/31/08). PI: Kevin R. Coffey (UCF).

26. Co-PI, "Lab Facilities Computing Upgrade", Intel Corporation $46,101, (06/05). PI: Robert Heard (CMU).

25. PI, "Calorimetric Studies of Single- and Multi-Layer Thin Films in Recording Technology" Seagate $70,000, (7/1/03-6/31/04).

24. PI, "Calorimetric Studies of Single- and Multi-Layer Thin Films in Recording Technology" Seagate $62,000, (7/1/02-6/31/03).

23. Co-PI, "Silicide quantum dots for nanoelectronics", NSF ECS-0210647, $89,871 (7/15/02-1/14/04). PI: David Greve (CMU).

22. Co-PI, "Impact of dislocations on a phase transformation: simulation of microstructural

evolution", PTIA, $55,500 (9/01-12/02), Collaborator, Jeffrey Rickman (Lehigh University).

21. Co-PI, "Magnetic Tunnel Junctions for the Magnetic Random Access Memory", Pennsylvania Digital Greenhouse, $300,000, (9/01-8/04), PI: Robert White. Other Co-PIs: Jiangang Zhu, and Robert Hoburg (CMU).

20. PI, "Calorimetric Studies of Single- and Multi-Layer Thin Films in Recording Technology", Seagate $55,000, (7/01-6/02).

19. PI, "Creativity Award – Microstructure Evolution in Thin Film: Cu alloys and microcalorimetry, NSF DMR-9996315, $224,793 (9/01-8/03).

18. PI, "Calorimetric Studies of Single- and Multi-Layer Thin Films in Recording Technology" Seagate $57,000, (7/00-6/01).

17. PI, "Magnetic Properties of $L1_0$ Alloys", Data Storage Systems Center, Carnegie Mellon University, $80,000, (9/00-8/01).

16. Co-PI, "Materials Research Science and Engineering Center", NSF DMR-0079996, $4,300,000, (9/00–8/05). PI: Gregory Rohrer, other Co-PI's: Brent L. Adams, David Cassasent, David Kinderlehrer, Anthony D. Rollett, Robert Suter, Shlomo Ta'asan (CMU).

15. Co-PI, "Development of Equipment for Fabrication of Quantum Cellular Automata", NSF ECS-0079485, $209,867, CMU cost sharing $100,000, (9/00-8/01). PI: David Greve.

14. Co-PI, "Collaborative to Integrate Research and Education (CIRE)" with Florida A&M University (FAMU), Co-PI, NSF, $150,748 (sub-contract from FAMU), (9/99-8/02). PI: H. Garmestani (FAMU).

13. Co-PI (starting in 1999), National Science Foundation, "Materials Research Science and Engineering Center – Mesoscale Interface Mapping Project", $3,567,000, (5 yrs, 9/96-8/00), PI: Brent L. Adams, David Cassasent, David Kinderlehrer, Anthony D. Rollett, Robert Suter, Shlomo Ta'asan (CMU).

12. PI, IBM, "University Partnership Program", $40,000, (1 yr, 9/99-8/00).

11. Co-PI, Sandia National Laboratory, "Automated Analysis of Electron Micrographs)", $20,989 (3 mos., 7/98-9/98).Co-PI: Jeffrey M. Rickman (Lehigh).

10. PI, National Science Foundation (NSF), DMR-9713439 Amendment, "REU - "Evolution of grain structure in thin film reactions", $5000 (0.5 years, 3/98-10/98). Co-PI: Jeffrey M. Rickman (Lehigh).

9. PI, National Science Foundation (NSF), DMR-9713439, "Evolution of grain structure in thin film reactions", $369,706 (4 years, 11/97-10/01). Co-PI: Jeffrey M. Rickman (Lehigh).

8. Co-PI, National Science Foundation (NSF), DMR-9626279, “Acquisition of an automated digital transmission electron microscope”, $709,300 (2 years, 8/96-7/98) and $450,000 matching funds from Lehigh University. PI: David A. Smith. Co-PIs: Katy Barmak, Helen M. Chan, Charles E. Lyman, Jeffrey. M. Rickman, and David B. Williams (Lehigh).

7. PI, Brookhaven National Laboratory (BNL) 725057, primary contract Department of Energy (DoE) New Initiative DE-AC02-76CH00016, “Magnetic exchange coupling in layered thin-film composites of hard and soft ferromagnets: role of processing and structure”, $125,643 (2/96 – 7/00)

6. Co-PI, Department of Energy (DoE), "Environmental scanning electron microscope - Research Instrumentation Grant", $245,120 and $91,800 matching funds from Industry and Lehigh University (1/95-6/97). PI: A. Marder. Other Co-PIs: Katy Barmak, and David B. Williams (Lehigh).

5. PI, National Science Foundation (NSF), DMR-9458000, National Young Investigator award (NYI), $500,000 (5 years, 9/94-8/00)) and the following matching funds from companies.

Hoeganaes, $27,000 (1998-99)
TA Instruments, $50,000 (1997)
AMP, Inc. $22,000 (1996)
Perkin Elmer $9631 (1996)
Penkem, Inc. $45,000 (1995)
Tencor, Inc. $55,225 (1994)
TA Instruments, Inc. $7048 (1994)
IBM, $5000 (1994)

4. PI, National Science Foundation (NSF), DMR-9411146, "Acquisition of an ultrahigh vacuum sputtering system for the preparation of nanostructured metal films", $196,450 (2 years, 6/94-11/96), and $125,000 matching funds from Lehigh University.

3. PI, National Science Foundation (NSF), DMR-9308651, "Role of grain structure and grain boundary diffusion in thin film reactions", $238,000 (3 years, 12/93-5/97).

2. Co-PI, National Science Foundation (NSF), DMR-9256332, "Graduate research traineeship in Materials Science and Engineering", $555,000 (5 years, 7/93-6/98). PI: David B. Williams. Co-PIs - Katy Barmak, Helen M. Chan, Martin P. Harmer, and Arnold M. Marder.

1. Co-PI, Department of Energy (DoE), DE-93-01-SR010, "Functionally gradient materials for thermal barrier coatings in advanced gas turbine systems, $750,000 (3 years, 9/93-8/96). PI: A. R. Marder. Other Co-PIs: Helen M. Chan, and Martin P. Harmer (Lehigh).

PATENTS, PROVISIONAL PATENTS and DISCLOSURES

5. **U.S. Patent 11,410,931 –** Crystallographic Orientations of Ru Films
Inventors: Coffey, Kevin R., Dein, Edward, Ezzat, Sameer, Mani, Prabhu Das, Barmak, Katayun

4. **U.S. Patent 10,332,661 –** Rare Earth-Free Permanent Magnetic Material
Inventors: Barmak, Katayun, Lewis, Laura H.

3. **U.S. Patent 9,117,821 –** Oriented Crystal Nanowire Interconnects
Inventors: Barmak, Katayun, Choi, Dooho, Coffey, Kevin R.

2. **US Patent 9,076,476** – Thin-Film Media Structures for Perpendicular Magnetic Recording and Storage Devices Made Herewith
Inventors: Granz, Steven D., Barmak, Katayun, Kryder, Mark H.

1. **US Patent 6,846,734** – Method and process to make multiple-threshold metal gates CMOS technology
Inventors: Amos, Ricky; Barmak, Katayun; Boyd, Diane C.; Cabral, Jr., Cyril; Leong, Meikei; Kanarsky, Thomas S.; Kedzierski, Jakub Tadeusz

BOOKS and BOOK CHAPTERS

6. Metallic Films for Electronic, Magnetic, Optical and Thermal Applications: Structure, Processing and Properties, eds. K. Barmak, K. R. Coffey, Woodhead Publishing Ltd. (now Elsevier), 2014.
ISBN 978-0-85709-057-7 (print)
ISBN 978-0-85709-629-6 (online)

- 3 Chapters by Barmak
  - Crystal Orientation Mapping in Scanning and Transmission Electron Microscopes
  - Post-Deposition Grain Growth in Metallic Films
  - Disorder-order Transformations in Metallic Films

5. Orientation Mapping, A. D. Rollett and K. Barmak, Chapter in Physical Metallurgy, eds. D. Laughlin, K. Hono, Elsevier, 2014. Print Book ISBN: 9780444537706, eBook ISBN: 9780444537713

4. Hollow-cone dark-field transmission electron microscopy for grain size and dislocation-density quantification of nanocrystalline materials, B. Yao, H. Heinrich, K. Barmak, K. R. Coffey, Kyu Cho, and Y.H. Sohn, in "Microscopy: Science, Technology, Applications and Education, A. Méndez-Vilas, and J. Díaz (Eds), , (Formatex Research Center, Badajos, Spain, 2010). Vol. 2, pp. 1319-1326. ISBN (13): 978-84-614-6190-5

3. J. M. Rickman, K. Barmak, "Microstructural characterization associated with solid-solid transformations", Handbook of Materials Modeling, Springer, Netherlands, 2391-2402 (2005).

2. Magnetic Ultrathin Films, Multilayers and Surfaces - 1997, eds. J. Tobin, D. Chambliss, D. Kubinski, K. Barmak, P. Dederichs, W. de Jonge, T. Katayama, A. Schuhl, Materials Research Society Symposium Proceedings **475** (1997) pp. 1-622.

1. Polycrystalline Thin Films: Structure, Texture, Properties and Applications, eds. K. Barmak, M. A. Parker, J. A. Floro, R. Sinclair, D. A. Smith, Materials Research Society Symposium Proceedings **343** (1994) pp. 1-772.

PUBLICATIONS IN ARCHIVAL JOURNALS

Researcher ID: A-9804-2008
Web of Science ID: AFU-8454-2022
http://orcid.org/0000-0003-0070-158X
H-Index: 55 (Google Scholar)
i10 Index 177
Citations: 10106 (9809)

211. Andrew P. Warren, Xuan Liu, Vimal Kamenini, Kevin R. Coffey, Katayun Barmak, "Coherently Scattering Domain Size vs. Grain Size in Thin Metallic Films: A Comparative Study by X-ray Diffraction and Transmission Electron Microscopy", in preparation.

210. Shao-Yu Chen, Yi-Hsun Chen, Ping-Yuan Lo, Kyle Boschen, Chih-En Hsu, Yung-Ning Hsu, Luke Holtzman, Guan-Hao Peng, Chun-Jui Huang, Madisen Holbrook, Wei-Hua Wang, Katayun Barmak, James Hone, Pawel Hawrylak, Hung-Chung Hsueh, Jeffrey Davis, Shun-Jen Cheng, and Michael Fuhrer, "Efficient light upconversion via resonant exciton-exciton annihilation of dark excitons in few-layer transition metal dichalcogenides", submitted for publication.

209. Madisen Holbrook, Julian Ingham, Daniel Kaplan, Luke Holtzman, Brenna Bierman, Nicholas Olsen, Luca Nashabeh, Song Liu, Xiaoyang Zhu, Daniel Rhodes, Katayun Barmak, James Hone, Raquel Queiroz, Abhay Pasupathy, "Real-Space imaging of the band topology of transition metal dichalcogenides", submitted for publication.

208. Yanxing Li, Chuqiao Shi, Fan Zhang, Xiaohui Liu, Yuan Xue, Viet-Anh Ha, Qiang Gao, Chengye Dong, Yu-chuan Lin, Luke N Holtzman, Nicolas Morales-Durán, Hyunsue Kim, Yi Jiang, Madisen Holbrook, James Hone, Katayun Barmak, Joshua Robinson, Xiaoqin Li, Feliciano Giustino, Eslam Khalaf, Yimo Han, Chih-Kang Shih, "Robust Super-Moiré in Large Angle Single-Twist Bilayers", submitted for publication.

207. Katayun Barmak, Emily Lynch, Michael Berkson, Aren Small, Zeenia Dumasia, Ruby Aidun, Alexis Hagadorn, "Copper pigment-induced degradation of paper in European early printed books: A factorial design study", J. American Inst. Conservation, submitted for publication.

206. Anjaly Rajendran, Zhiying Wang, Thomas Darlington, Yinjie Guo, Jacob Amontree, Kevin W. C. Kwock, Luke N. Holtzman. Kenji Watanabe, Takashi Taniguchi, Katayun Barmak, Cory Dean, James Schuck, Hae Yeon Lee, James Hone, "High-Performance p-Type Transistor in Monolayer 2H-$MoTe_2$", J. Phys. Chem. C **129**, 5, 2830–2836 (2025).
DOI: 10.1021/acs.jpcc.4c08418

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17. K. Barmak, C. Michaelsen, R. Bormann, G. Lucadamo, "Reactive phase formation in sputter-deposited Ni/Al thin films," Mater. Res. Soc. Symp. Proc. **382**, 33-38 (1995).

16. K. R. Coffey, K. Barmak, "A unified approach to grain boundary diffusion and nucleation in thin film reactions", Mater. Res. Soc. Symp. Proc. **343**, 193-204 (1994).

15. S. M. Lee, K. Barmak, "Amorphous/crystalline structure and phase transformation in metastable semiconducting $Ge_{1-x}Sn_x$", Mater. Res. Soc. Symp. Proc. **321**, 313-318 (1994).

14. K. Barmak, "The use of TEM and AEM in studying reactions and phase transformations in thin films", Proceedings of the **51st** Annual Meeting of the Microscopy Society of America, 842-843 (1993).

13. *(Invited)* L. A. Clevenger, Q. Z. Hong, R. Mann, J. M. E. Harper, K. Barmak, C. Cabral, Jr., C. Nobili and G. Ottaviani, "Silicide formation in Ti-Si and Co-Si reactions", Mater. Res. Soc. Symp. Proc. **311**, 253-264 (1993).

12. J. G. Holl-Pellerin, S. G. A. Anderson, P. S. Ho, K. R. Coffey, J. K. Howard, K. Barmak, "Grain boundary diffusion in Co/Cu and Co/Cr bilayer magnetic thin films", Mater. Res. Soc. Symp. Proc. **313**, 205-210 (1993).

11. K. Barmak, K. R. Coffey, "Grain boundary diffusion controlled precipitation as a model for thin film reactions", Mater. Res. Soc. Symp. Proc. **311**, 51-56(1993).

10. L. A. Clevenger, Q. Z. Hong, J. M. E. Harper, C. Cabral, Jr., R. Mann, C. Nobili, G. Ottaviani, K. Barmak, "Silicide formation and transformations in Ti-Si, Co-Si and Ni-Si Reactions, Mater. Res. Soc. Symp. Proc. **311**, 253-258 (1993).

9. E. Ganin, S. Wind, P. Ronsheim, A. Yapsir, K. Barmak, J. Bucchignano, R. Assenza, "$TiSi_2$ formation on submicron polysilicon lines: role of line width and dopant concentration", Mater. Res. Soc. Symp. Proc. **303**, 109-114 (1993).

8. Q. Z. Hong, K. Barmak, L. A. Clevenger, "Effects of ion implantation on crystallization of amorphous $CoSi_2$", Mat. Res. Soc. Symp. Proc. **279**, 541-546 (1993).

7. K. Barmak, L. E. Levine, D. A. Smith, Y. Komem, "In situ observation of C49 to C54 $TiSi_2$ transformation", Proceedings of the **50th** Annual Meeting of the Electron Microscopy Society of America, 1356-1357 (1992).

6. A. Mutscheller, L. A. Clevenger, J. M. E. Harper, C. Cabral Jr., K. Barmak, "Effect of deposition parameters on intrinsic stress, phase transformation and stress relaxation in thin Ta films, Mater. Res. Soc. Symp. Proc. **239**, 51-56 (1992).

5. K. Barmak, L. A. Clevenger, P. D. Agnello, E. Ganin, M. Copel, P. Dehaven, J. Falta, F. M. d'Heurle, C. Cabral Jr., "Effect of an interfacial Ti layer on the formation of $CoSi_2$ on Si", Mater. Res. Soc. Symp. Proc. **238**, 575-562 (1992).
DOI: http://dx.doi.org/10.1557/PROC-238-575

4. K. Barmak, K. R. Coffey, D. A. Rudman, S. Foner, "Effect of microstructure on phase formation in the reaction of Nb/Al multilayer thin films", Mater. Res. Soc. Symp. Proc. **230**, 61-66 (1992).

3. K. R. Coffey, K. Barmak, D. A. Rudman, S. Foner, "First phase formation kinetics in the reaction of Nb/Al, Mater. Res. Soc. Symp. Proc. **230**, 55-60 (1992).

2. K. Barmak, K. R. Coffey, D. A. Rudman, S. Foner, "Characterization of phase formation in multilayer thin films of Nb/Al by cross-sectional transmission electron microscopy", Materials Research Society, Selected Topics in Electronics Materials, 267 (1988).

1. G. Yurek, K. Przybylski, K. Barmak, S. N. Basu, "Oxidation behavior of fine-grained rapidly solidified alloys", Corrosion '88, Paper No. 132, NACE, (1988).

IBM PUBLICATIONS

9. K. Barmak, M. A. Lee, D. J. Schepis, K. Seshan, "An Instrument for Measurement of Pulsed Elements", IBM Technical Disclosure, rated publish.

8. Q. Z. Hong, K. Barmak, F. M. d'Heurle," Formation of a C49 $TiGe_2$ phase during annealing a coevaporated $Ti_{0.33}Ge_{0.67}$ alloy", IBM Res. Report RC 18997(82973), (1993).

7. L. A. Clevenger. Q. Z. Hong, R. Mann, J. M. E. Harper, K. Barmak, C. Cabral, Jr., C. Nobili, G. Ottaviani, "$TiSi_2$ and $CoSi_2$ reactions for CMOS Applications", IBM Res. Report RC 18915(82599), (1993).

6. L. A. Clevenger. Q. Z. Hong, R. Mann, J. M. E. Harper, K. Barmak, C. Cabral, Jr., C. Nobili, G. Ottaviani, "Silicide formation Ti-Si and Co-Si Reactions", IBM Res. Report RC 18861(82599), (1993).

5. K. Barmak, J. Gambino, "Separation of Gate Salicidation from Source/Drain Salicidation", IBM Technical Disclosure Bulletin **34**, 474 (1992).

4. Q. Z. Hong, K. Barmak, L. Clevenger, "Composition dependence of crystallization of Co-Si alloys", IBM Res. Report RC 17931(78809), (1992).

3. A. Mutscheller, L. A. Clevenger, J. M. E. Harper, C. Cabral, K. Barmak, "Effect of deposition conditions on intrinsic stress, phase transformation, and stress relaxation in tantalum thin films", IBM Research Report RC 17546(77456), (1992).

2. K. Barmak, "Improved Fuses for VLSI Circuits", IBM Technical Disclosure Bulletin **34**, 399 (1991).

1. K. Barmak, R. Bennett, S. Subbanna, A. Yapsir, "Double Poly Improved NTX Transistor Structure", IBM Technical Disclosure Bulletin **34**, 323 (1991).

INVITED TALKS, PROJECT REVIEW PRESENTATIONS (Partial)

102. “Microstructure by Design: Thin Film Grain Growth Experiments, Simulations, Data Analytics”, EMA Conference, Denver, CO. February 2025.

101. “Epitaxial Electrodeposition of Metals for Interconnects beyond Cu”, ECS Conference, Honolulu, HI, October 2024.

100. “Advances in Experimental Studies of Grain Growth”, Symposium in honor of Carl Thompson, TMS Conference, Orlando, FL, March 2024.

99. “Interconnects Beyond Cu”, Boston College, Boston, MA, October 2022.

98. “Towards a Predictive Theory of Grain Growth: Experiments, Simulations”, online September 2022.

97. “Towards a Predictive Theory of Grain Growth: Experiments, Simulations”, Max Planck Institute, Düsseldorf, online October 2021.

96. “Towards a Predictive Theory of Grain Growth: Experiments, Simulations and Data Analytics”, WCCMS 2020, held online January 2021.

95. “Grain structure, grain growth and evolution of the grain boundary network in polycrystalline materials: Experimental Studies”, SIAM 2020, held online July 2020.

94. “Grain Growth in Metallic Films: Experiments, Simulations and Data Analytics”, Materials Research Society Conference, Boston, MA, December 2019.

93. “Cu and Interconnects Beyond Cu”, Yale University, New Haven, CT, October 2019.

92. “Synthesis and Characterization of Transition Metal Dichalcogenide: GrapheneUS Conf., City University of New York, New York, NY, March 2019.

91. “Cu and Interconnects Beyond Cu”, University of Connecticut, Storrs, CT, February 2019.

90. WoPhyS ’18, Annual Conference for Undergraduate Women in Physical Sciences, University of Nebraska, Lincoln, NE, October 2018.

89. “Grain Structure, Grain Boundary Character Distribution and Grain Growth in Thin Metallic Films”, SIAM Conference, Portland, OR, July 2018.

88. “Grain Structure, Grain Boundary Character Distribution and Grain Growth in Thin Metallic Films”, University of Utah Math Dept., Salt Lake City, UT, April 2018.

87. “Interconnects Beyond Cu”, University of Michigan, Ann Arbor, MI, November 2017.

86. Transmission Electron Microscopy (TEM): A Few Examples of Materials Studies”, Lamont Doherty Earth Observatory, November 2017.

85. “Cu and Interconnects Beyond Cu”, Advanced Metallization Conference, Austin, TX, October 2017.

84. “Puzzle of Grain Growth Stagnation in Metallic Films: Simulations and Experiments”, Topics in Applied Non-linear Analysis: Recent Advances and New Trends, Conference in Honor of David Kinderlehrer’s 75th Birthday, Pittsburgh, PA, July 2016.

83. “Grain Growth in Metallic Films: Simulations and Experiments”, SIAM Conference, Philadelphia, PA, May 2016.

82. “Grain Boundary and Surface Scattering of Electrons in Metals for Deeply-Scaled Interconnects”, University of Southern Florida, April 2016.

81. “Grain Growth and the Puzzle of its Stagnation in Metallic Films: Experiment, Simulation and Analytic Theory”, TMS Conference, Orlando, FL, March 15-19, 2015.

80. “Grain Growth and Grain Growth Stagnation in Metallic Films: The Curious Tail of a Tale and an Ear”, The Courant Institute, New York University, November 2014.

79. (*Plenary Lecture*) “Grain Growth and Grain Growth Stagnation in Thin Films: The Curious Tale of a Tail and an Ear”, Continuum Models Discrete Systems, University of Utah, Salt Lake City, UT, July 21-25, 2014.

78. “Grain Boundary and Surface Scattering in Interconnect Metals”, Rensselaer Polytechnic Institute, February 2014.

77. “Grain Boundary and Surface Scattering in Interconnect Metals”, IBM, Albany, October 2013.

76. “Impact of Grain Boundary and Surface Scattering on Resistivity”, Advanced Metallization Conference 2013, College of Nanoscale Science and Engineering, SUNY, Albany, October 2013.

75. (*Plenary Lecture*) “The A1 to $L1_0$ Transformation in FePt, FeNi and Related Alloys”, International Symposia on Metastable Amorphous and Nanocrystalline Materials (ISMANAM), Turin, Italy, July 2013.

74. $L1_0$ FePt: Ordering, Anisotropy Constant and their relation to Film Composition, 12^{th} joint Intermag and Magnetism and Magnetic Material Meeting, Chicago, Illinois, January 2013.

73. “Grain Growth and the Puzzle of its Stagnation in Thin Films: Comparison of Experiments and Simulations”, Institute for Pure and Applied Mathematics, University of California, Los Angeles, November 2012.

72. “Surface and Grain Boundary Scattering in Nanometric Cu Films: A Quantitative Analysis Including Twin Boundaries”, Case Western Reserve University, Cleveland, OH, November 2011.

71. “Surface and Grain Boundary Scattering in Nanometric Cu Films: A Quantitative Analysis Including Twin Boundaries”, Rutgers University, New Brunswick, NJ, November 2011.

70. “Surface and Grain Boundary Scattering in Nanometric Cu Films: A Quantitative Analysis Including Twin Boundaries”, EFRC presentation, Columbia University, NY, November 2011.

70. “Mapping Nanoscale Structures”, Dean’s Advisory Council, Carnegie Institute of Technology, Carnegie Mellon University, Pittsburgh, PA, April 2011.

69. Quantitative Kinetic Models and Experiments of $L1_0$ Formation in FePt, CoPt and Related Alloy Films”, Information Storage Industry Consortium Meeting, Santa Clara, CA, January 2011.

68. “Classical Resistivity Size Effect: Surface and Grain Boundary Scattering in Cu Thin Films and Lines”, Mesoscale Interface Mapping Project Seminar, Pittsburgh, PA, December 2010.

67. Quantitative Kinetic Models and Experiments of $L1_0$ Formation in FePt, CoPt and Related Alloy Films”, Information Storage Industry Consortium Meeting, Milpitas, CA, August 2010.

66. *(Outreach)* Research Experience for Undergraduate Summer Professional Development Series,

65. "Orientation Mapping in the Transmission Electron Microscope", Mesoscale Interface Mapping Project Summer School, Pittsburgh, PA June 2010.

64. Quantitative Kinetic Models and Experiments of $L1_0$ Formation in FePt, CoPt and Related Alloy Films", Pittsburgh, PA, May 2010.

63. "Thermodynamics and Kinetics of $L1_0$ Phase Formation in FePt and Related Ternary Alloys", IFW Dresden, Germany, April 2010.

62. "Experimental Studies on Interfacial and Grain Boundary Scattering in Cu, 11^{th} International Workshop on Stress Induced Phenomena in Metallization", Bad Schandau, Germany, April 2010.

61. Quantitative Kinetic Models and Experiments of $L1_0$ Formation in FePt, CoPt and Related Alloy Films", Information Storage Industry Consortium Meeting, Berkeley, CA, January 2010.

60. "Heat-Assisted Magnetic Recording: The Kinetics and Thermodynamics of $L1_0$ Formation in FePt and Related Ternary Alloys", David Laughlin Symposium, MS&T Conference, Pittsburgh, October 2009.

59. "Grains, Grain Growth and the Impact of Grain Boundaries on Electrical Resistivity", Columbia University, June 2009.

58. "Lessons from Materials Science: Dominant role of Grain Boundary Scattering in the Resistivity of Encapsulated Cu Films", Physics Colloquium, Carnegie Mellon University, May 2009.

57. "$L1_0$ Alloys for HAMR Media: On the Nucleation of the $L1_0$ phase", Seagate Research, April 2008.

56. "Grain Growth and the Puzzle of its Stagnation in Thin Films: The Tale of a Tail and an Ear?", California Institute of Technology, March 2008.

55. "$L1_0$ Ordered Intermetallics for Ultrahigh Density Magnetic Recording Media: Phase Formation and the Role of Alloy Chemistry and Composition", Materials Research Society Conference, Boston November 2006.

54. "Resistivity of Sub-45 nm Cu Interconnects: Processing, Transport, and Microstructural Characterization – 1292.008", SRC CAIST Back End Workshop, SUNY, Albany, May 2006.

53. "The A1 to $L1_0$ transformation in FePt, FeCuPt and FeNiPt", Seagate Research, April 2006.

52. “An Old Problem, A New Approach: Grain Boundary Properties and Grain Growth”, University of Central Florida, Orlando, May 2005.

51. “An Old Problem, A New Approach: Grain Boundary Properties and Grain Growth”, Boston University, Boston, March 2005.

50. “Microstructural design of polycrystalline materials: nucleation and growth, grain growth” Plasticity Conference, Kauai, January 2005.

49. “Grain boundary properties and grain growth: Al Foils, Al Films”, Materials Research Society Conference, San Francisco, April 2004.

48. “Calorimetric studies of the A1 to $L1_0$ transformation in FePt and related ternary alloys”, Seagate Research, November 2003.

47. “Calorimetric studies of the A1 to $L1_0$ phase transformation in FePt and CoPt”, Seagate Research, July 2003.

46. “Cu and Cu-alloy thin films: resistivity, texture and grain structure”, Interconnect Technology Seminar, IBM T. J. Watson Research Center, July 2003.

45. “Cu and Cu-alloy thin films”, IBM T. J. Watson Research Center, April 2003.

44. “Cu and Cu-alloy thin films: resistivity, texture and grain structure”, Materials Research Society Conference, San Francisco, April 2003.

43. “Differential scanning calorimetry: thin film reactions and phase transformations”, IBM T. J. Watson Research Center, September 2002.

42. “Texture and resistivity of Cu and dilute Cu alloy thin films”, Materials Research Society Conference, San Francisco, April 2002.

41. “Differential scanning calorimetry”, Seagate, Minneapolis, February 2002.

40. “Phase transformations in polycrystalline thin films: experiment, theory and simulation”, Columbia University, March 2001.

39. “Ordering and grain growth in CoPt and FePt thin films”, IBM Almaden Research Center, February 2001.

38. “Magnetic Signature of compositional gradient in exchange spring bilayer thin films of CoPt/Co”, Brookhaven National Laboratory, January 2001.

37. “High anisotropy constant materials for magnetic recording media: $L1_0$ ordering and grain growth in CoPt and FePt thin films”, Data Storage Systems Center, Carnegie Mellon University, September 2000.

36. “Dissociation of dilute copper alloys”, IBM T. J. Watson Research Center, August 2000.

35. “Grain growth and ordering in CoPt and FePt thin films”, Seagate Technology Lab, Pittsburgh, July 2000.

34. “Experimental and theoretical studies of thin film reactions”, Indiana University of Pennsylvania, February 2000.

33. “Thin film reactions”, Department of Chemical Engineering, Carnegie Mellon University, October 1999.

32. “Phase Transformations in Thin Metal Films”, Naval Research Laboratory, Washington, DC, October 1999.

31. “Phase transformations and mechanical behavior of metal thin films and multilayers”, University of Pittsburgh, Department of Mechanical Engineering, October 1999.

30. “Semiconductor Metallization: Phase Transformations in Thin Films”, University of Pittsburgh, Department of Materials Science and Engineering, September 1999.

29. “Thin films”, Seminar Series, Carnegie Mellon University, September 1999.

28. “Nucleation and growth in thin film reactions: microstructural implications”, Rensselaer Polytechnic Institute, March 1999.

27. “Grain structure evolution in thin film reactions”, Case Western Reserve University, April 1998.

26. “Evolution of grain structure in thin film reactions”, Carnegie Mellon University, March 1998.

25. “Contact metallization and the solid state reaction of thin films”, Princeton University, January 1998.

24. “Evolution of grain structure in thin film reactions”, Penn State, October 1997.

23. “Role of grain boundaries and interfaces in thin film reactions”, Boundaries and Interfaces in Materials: The David A. Smith Memorial Symposium, TMS/ASM Meeting, Indianapolis, IN, Sept. 15,-18, 1997.

22. “Ultrasonic characterization of particles in electrochemical deposition baths,” presented at the work shop on Ultrasonic and Dielectric Characterization Techniques for Suspended Particulates, NIST, Gaithersburg, MD, August 4-6, 1997.

21. “Role of interfaces and grain boundaries in thin film reactions”, SUNY, Albany, NY, March 1997.

20. “Evolution of grain structure in thin film reactions”, Johns Hopkins University, Baltimore, MD, March 1997.

19. “Evolution of grain structure in thin film reactions”, II. Fabrication of thermal barrier coatings by electrochemical methods”, SUNY, Stony Brook, NY, March 1997.

18. “Evolution of grain structure in thin film reactions, TMS conference, Orlando, Florida, Feb. 10-14, 1996.

17. “Reactive phase formation in thin films: evolution of grain structure,” Cambridge University, England, June 1996.

16. “Reactive phase formation in thin films: evolution of grain structure,” University of Manchester, England, June 1996.

15. “Reactive phase formation in thin films: evolution of grain structure,” Department of Mechanical, Industrial and Manufacturing Engineering, Northeastern University, Boston, MA, May, 1996.

14. “Electrodeposited functionally graded composite coatings”, Microscopy of Composite Materials III, Organized by the Royal Microscopical Society, Oxford, England, April 1996.

13. “Tailoring of silicides and aluminides for metallization in microelectronics, ISHM local meeting, Lehigh University, February 1996.

12. “Reactive phase formation in thin films: evolution of grain structure”, Fall meeting of the Materials Research Society, Boston, MA, December, 1995.

11. “Metal films and coatings”, Sigma Xi luncheon meeting, Lehigh University, November 1994.

10. “Reactive phase formation at interfaces”, Department of Chemistry, Lehigh University, November, 1994.

9. “Metal films and coating”, Department of Chemistry, Lehigh University, June, 1994.

8. “Solid-state reactions in thin films”, Johns Hopkins University, October 1994.

7. “Reactive phase formation at interfaces”, University of Konstanz, Germany, August 1994

6. “Reactive phase formation at interfaces”, GKSS Research Center, Geesthacht, Germany July, 1994.

5. “Metal films and coatings”, Lawrence University, Wisconsin, February 1994.

4. "The use of transmission and analytical electron microscopy in studying reactions and phase

transformations in thin films", Microscopy Society of America, August 1993.

3. "Role of grain boundary diffusion in thin film reactions", AT&T, December 1992.

2. "Phase formation in the reaction of multilayer thin films of Nb/Al", Stevens Institute of Technology, Department of Materials Science and Engineering, February 1991.

1. "Phase formation in the reaction of Nb/Al multilayers: a new theory of thin film reaction kinetics", Brookhaven National Laboratory, April 1991.

PARTIAL LIST OF CONFERENCES AND WORKSHOPS ATTENDED

87. TMS Conference, Las Vegas, NV, March 2025.

86. EMA Acers Conference, Denver, CO, February 2025.

85. MMM and Intermag Conference, New Orleans, LI, January 2025.

84. ECS Conference, Honolulu, HI, October 2023

83 Microscopy and Microanalysis Conference, Columbus, OH, July-August 2024.

82. TMS Conference, Orlando, FL, March 2024.

81. ASM Conference, Detroit, MI, October 2023.

80. Microscopy and Microanalysis Conference, Minneapolis, MN, July-August 2023.

79. Materials Research Society Conference, Boston, MA, November-December 2022.

78. MS&T Conference, Pittsburgh, PA, October 2022.

77. 2022 Workshop on Methods for Three-Dimensional Microstructural Studies, Carnegie Mellon University, Pittsburgh, PA, August 2022.

76. SIAM Conference, Pittsburgh, PA, July 2022.

75. WCCM Conference, Online, January 2021.

74. SIAM Conference, Online, July 2020.

73. Materials Research Society Conference, Boston, MA, December 2019.

72. SIAM Conference, Portland, OR, July 2018.

71. Advanced Metallization Conference, Austin, TX, October 2017.

70. SIAM Conference, Philadelphia, PA, May 2016.

69. Microscopy and Microanalysis Meeting, Portland, OR, August 2015.

68. TMS Conference, Orlando, FL, March, 2015

67. American Vacuum Society Conference, Baltimore, MD, November 2014.

66. Magnetism and Magnetic Materials, Denver, CO, November 2013.

65. Advanced Metallization Conference, College of Nanoscale Science and Engineering, October 2013.

64. Microscopy and Microanalysis Meeting, Indianapolis, IN, August 2013.

63. International Symposia on Metastable Amorphous and Nanocrystalline Materials (ISMANAM), Turin, Italy, July 2013.

62. Materials Research Society Meeting, San Francisco, April 2013.

61. Magnetism and Magnetic Materials/Intermag, Chicago, IL, January 2013.

60. IPAM, UCLA, CA, November 2012.

59. Magnetism and Magnetic Materials, Scottsdale, AZ, October 2011.

58. Advanced Storage Technology Consortium Meeting, Santa Clara, CA, January 2011.

57. Magnetism and Magnetic Materials, Atlanta, GA, November 2010.

56. MS&T, Houston, TX, October 2010.

55. Information Storage Industry Consortium Meeting, Milpitas, CA, August 2010.

54. Microscopy and Microanalysis Meeting, Portland, OR, August 2010.

53. Recrystallization and Grain Growth Conference, Sheffield, UK, July 2010.

55. Information Storage Industry Consortium Meeting, Pittsburgh, PA, May 2010.

52. 11th International Workshop on Stress Induced Phenomena in Metallization, Bad Schandau, Germany, April 2010.

55. Information Storage Industry Consortium Meeting, Berkeley, CA, January 2010.

51. MS&T, Pittsburgh, PA, October 2009.

50. Microscopy and Microanalysis, Richmond, VA, August 2009.

49. Materials Research Society Meeting, San Francisco, April 2009.

48. Magnetism and Magnetic Materials, Austin, TX, November 2008.

47. MS&T, Pittsburgh, PA, October 2008.

47. International Conference on the Texture of Metals, ICOTOM 15, Pittsburgh, PA, June 2008.

46. Magnetism and Magnetic Materials, Tampa, FL, November 2007.

45. MORIS conference, Pittsburgh, PA, September 2007.

44. The 10^{th} joint Intermag/MMM conference, Baltimore, MD, January 2007.

43. Materials Research Society Meeting, Boston, November 2006.

42. Semiconductor Research Corporation Back End Processing Workshop, SUNY Albany, NY, May 2006.

41. Magnetism and Magnetic Materials, San Jose, CA, October 2005.

40. MS&T, Pittsburgh, September 2005.

39. International Conference on the Texture of Metals, ICOTOM 14, Leuven, Belgium, July 2005.

38. Cu Resistivity Workshop, San Jose, CA, June 2005.

37. TMS, 134^{th} Annual Meeting and Exhibition, San Francisco, CA, February 2005.

36. Plasticity Conference, Kauai, HI, January 2004.

35. $L1_0$ Ordered Intermetallic and Related Phases for Permanent Magnet and Recording Applications, Copper Mountain, CO, August 2004.

34. Materials Research Society, San Francisco, CA, April 2004.

33. The 9^{th} joint Intermag/MMM conference, Annaheim, CA, January 2004.

32. Materials Research Society, San Francisco, CA, April 2003.

31. Intermag 2002, Amsterdam, April-May 2002.

30. Materials Research Society, San Francisco, CA, March-April 2002.

29. Materials Research Society, San Francisco, CA, April 2001.

28. The 8th joint Intermag/MMM conference, San Antonio, TX, January 2001.

27. Materials Research Society, San Francisco, CA, April 2000.

26. Materials Research Society, Boston, MA, November -December, 1999.

25. Materials Research Society, San Francisco, CA, April, 1999.

24. Materials Research Society, San Francisco, CA, April, 1998.

23. Materials Research Society, Boston, MA, December, 1997.

22. The Minerals, Metals, Materials Society, Orlando, Indianapolis, September, 1997.

21. Workshop on Ultrasonic and Dielectric Characterization Techniques for Suspended Particulates, NIST, Gaithersburg, MD, August 4-6, 1997.

20. The Minerals Metals Materials Society, Orlando, Florida, February, 1997.

19. Materials Research Society, Boston, MA, December, 1996.

18. Fourth International Symposium on Functionally Graded Materials, Tsukuba, Japan, October, 1996.

17. Microscopy and Microanalysis 1996, Minneapolis, MN, August, 1996.

16. The 11th International Congress on Thermal Analysis and Calorimetry, Philadelphia, PA, August, 1996.

15. Materials Research Society, San Francisco, CA, April, 1996.

14. The Microscopy of Composites III, Oxford, England, April, 1996.

13. Materials Research Society, Boston, MA, December, 1995.

12. Magnetism and Magnetic Materials, Philadelphia, PA, November, 1995.

11. The Young Investigator meeting, White Oaks, CA, October, 1995.

10. NIST workshop on nanoscale structural materials, Gaithersburg, August 1995.

9. Microbeam Analysis Society 1995, Breckenridge, CO, August, 1995.

8. Ceramic Society Meeting, Cincinnati, OH, April, 1995.

7. Materials Research Society, San Francisco, CA, April 1995.

6. Functionally Gradient Materials III, Lausanne, Switzerland, October, 1994.

5. Materials Research Society, San Francisco, CA, October 1994.

4. International Symposium on Mechanisms of Formation of Metastable Microstructures, Cambridge, U.K., July, 1993.

3. Materials Research Society, San Francisco, CA, April, 1993.

2. The Metals, Materials, Minerals Society Meeting, October, 1992.

1. Microscopy Society of America, Boston MA, August, 1992.

CONFERENCE PRESENTATIONS (without an accompanying proceedings' paper)

25. A. P. Warren, B. Yao, T. Sun, K. Barmak, M. F. Toney[3], and K. R. Coffey, "X-ray Scattering Study of Interface Evolution and Grain Growth in Encapsulated Cu Films" Materials Research Society Spring Meeting, San Francisco, April 2009.

24. T. Sun, B. Yao, A. P. Warren, D. Choi, K. Barmak, M. F. Toney, R. E. Peale, and K. R. Coffey, "Dominant Role of Grain Boundary Scattering in the Resistivity of Encapsulated Cu Films", Materials Research Society Spring Meeting, San Francisco, April 2009.

23. K. Barmak, A. Darbal, T. Nuhfer, D. J. Dingley, G. Meaden, J. Michael, T. Sun, K. R. Coffey, "Orientation Imaging of Nanocrystalline Copper and Platinum Films in the Transmission Electron Microscope", Materials Research Society Spring Meeting, San Francisco, April 2009.

22. A.D. Rollett, K. Barmak, and B. Radhakrishnan, "Simulation of Interconnect Microstructures", Materials Research Society Spring Meeting, San Francisco, April 2009.

21. K. Barmak, D. C. Berry, J. M. Rickman, "$L1_0$ Alloys for Heat Assisted Magnetic Recording (HAMR) Media: On the Nucleation of the $L1_0$ Phase in FePt and FeCuPt Alloy Films", Magnetism and Magnetic Materials Conference, Austin, TX, November 2008.

20. K. Barmak, D. C. Berry, B. Wang, "Determination of the Long Range Order Parameter in Fiber-Textured Films of $L1_0$ FePt", International Conference on the Texture of Metals, ICOTOM 15, Pittsburgh, PA, June 2008.

19. D. C. Berry, B. Wang, K. Barmak, T. J. Klemmer, "$L1_0$ FePt for Ultrahigh Density Magnetic Recording Media: Heats of Formation of the Ordered Intermetallics in the Fe-Pt System", Magnetism and Magnetic Materials, Tampa, FL, November 2007.

18. Heat Assisted Magnetic Recording Media: $L1_0$ FePt and the Impact of Ternary Additions of Cu and Ni on the Curie Temperature and the Ordering Transformation", MORIS conference, Pittsburgh, PA, September 2007.

17. K. Barmak, J. Kim, C.-S. Kim, W. E. Archibald, G. Rohrer, A. D. Rollett, S. Ta'asan, D. Kinderlehrer, H. Zhang, D. J. Srolovitz, "Grain boundary energy and grain growth in <111> fiber-textured Al films", MS&T, Pittsburgh, September 2005.

16. K. Barmak, J. Kim. C.-S. Kim, G. S. Rohrer, H. Zhang, D. Srolovitz, "Grain boundary energy as a function of misorientation in <111> fiber-textured Al films: Experiment and simulation", TMS, San Francisco, February 14-18, 2005.

15. K. Barmak, W. E. Archibald, A. D. Rollett, S. Ta'asan, D. Kinderlehrer, "Microstructural design of polycrystalline materials: nucleation and growth, grain growth", Plasticity 2005, Kauai, HI, January 2005.

14. K. Barmak, "Calorimetric studies of the A1 to $L1_0$ phase transformation in binary FePt and ternary FeCuPt and FeNiPt thin films", $L1_0$ Ordered Intermetallic and Related Phases for Permanent Magnet and Recording Applications, Copper Mountain, CO, August 2004.

13. K. Barmak, J. Kim, D. C. Berry, K. W. Wierman, E. B. Svedberg and J. K. Howard, "Calorimetric Studies of the A1 to $L1_0$ Transformation in FePt and Related Ternary Alloy Thin Films", The 9^{th} joint Intermag/MMM conference, Annaheim, CA, January 2004.

12. K. Barmak, J. Kim, L. H. Lewis, K. R. Coffey, M. F. Toney, A. J. Kellock and J.-U. Thiele "Stoichiometry – Anisotropy Connections in Epitaxial $L1_0$ FePt(001) Films", The 9^{th} joint Intermag/MMM conference, Annaheim, CA, January 2004.

11. K. Barmak, "Reactive phase formation in thin films: evolution of grain structure", DIFTRANS '98, Cherkasy, Ukraine.

10. C. Michaelsen, G. Lucadamo, K. Barmak, "Sequence of phase formation in the reaction of Ni/Al multilayer thin films", presented at the Materials Research Society Meeting, , Boston, MA, December 1-5,1997.

9. G. Lucadamo, K. Barmak, C. Michaelsen, J. Rickman, S. Tong, J. Codner, "Reactive phase formation and product grain size in Nb/Al multilayer thin films", presented at the Materials Research Society Meeting, Boston, MA, December 1-5, 1997.

8. K. Barmak, "Role of grain boundaries and interfaces in thin film reactions", Boundaries and Interfaces in Materials: The David A. Smith Memorial Symposium, TMS/ASM Meeting, Indianapolis, IN, Sept. 15-18, 1997.

7. K. Barmak, "Ultrasonic characterization of particles in electrochemcial deposition baths," presented at the work shop on Ultrasonic and Dielectric Characterization Techniques for

Suspended Particulates, NIST, Gaithersburg, MD, August 4-6, 1997.

6. K. Barmak, S. Banovic, H. M. Chan, L. Friedersdorf, M. P. Harmer, A. M. Marder, C. M. Petronis, D. Puerta, D. Susan, “Functionally graded electrodeposited thermal barrier coatings”, The Metals, Materials, Minerals Meeting, Orlando, FL, Feb. 10-14, 1997.

5. G. Lucadamo, K. Barmak, C. Michaelsen, ”Intermetallic Phase Formation in Nanoscale Ni/Al Multilayers, NIST workshop on nanoscale structural materials, Gaithersburg, MD. August 1995.

4. K. Barmak, C. Petronis, S. Banovic, A. R. Marder, “Fabrication of Functionally Graded Metal-Ceramic Coatings by electrodeposition”, American Ceramic Society, Cincinnati, OH, April 1995.

3. K. Barmak, "Mechanisms of grain structure development in the reaction of polycrystalline thin films", presented at the International Symposium on Mechanisms of Formation of Metastable Microstructures, Cambridge, U.K., July 1993.

2. K. Barmak, K. R. Coffey, D. A. Rudman, and S. Foner, "Characterization of intermetallic phase formation in multilayer thin films of Nb/Al by cross-sectional transmission electron microscopy", presented at the Annual Meeting of The Metallurgical Society, Las Vegas, NV, February 1989.

1. K. R. Coffey, K. Barmak, D. A. Rudman, and S. Foner, "Investigation of Nb/Al Diffusion Reactions by Scanning Calorimetry in Thin Film and Powder Metallurgy Processed Samples", presented at the Annual Meeting of The Metallurgical Society, Las Vegas, NV, February 1989.

SERVICE ACTIVITIES – COLUMBIA UNIVERSITY

University

- Presidential Teaching Awards (2012), member
- Presidential Teaching Awards (2013), member
- Presidential Teaching Awards (2014), chair
- Promotion and Tenure (2017, 2021)

College - SEAS

- Tenure Workshop (January 25, 2012) – Participant giving advice to junior faculty
- SEAS Days on Campus, Master Class (April 19, 2013)
    - Lessons from Materials Science and Engineering: The Electrical Resistivity of Nanometric Cu Films
- Dean Search Committee (2012-2013)
- Undergraduate Curriculum Committee (2014-2015)
- Task Force on the Masters Program (2013-2014)
- Promotion and Tenure (2014,2015, 2020)

Department

- Faculty Search Committee (2024)
- Doctoral Admissions/Fellowships/Financial Aid Committee (2022-2023)

- Materials Science and Engineering 1st Year Doctoral Advisor (Spring 2023)
- Chair, Materials Science Doctoral Committee (2017-)
- Undergraduate Advisor (Classes of 2017, 2019, 2021)
- Awards Committee (2016-)
- Space Advisory Committee to Chair (2016-)
- Materials Science and Engineering Program Committee Chair (2013-2019)
- APAM Research Conference (Fall 2011)
- Chair, Faculty Search Committee (2011-2012)

SERVICE ACTIVITIES - CARNEGIE MELLON

University

- None

College - CIT

- CIT Ad Hoc Promotion and Tenure Committee (2007)
- CIT Ad Hoc Promotion and Tenure Committee (2005)
- Department Head Search Committee, Mechanical Engineering (2005)
- Department Head Search Committee, Materials Science and Engineering (2005)
- Sigma Xi undergraduate research competition, Judge (2005)
- CIT Ad Hoc Promotion and Tenure Committee (2004)
- "Meeting of the Minds", Judge (2002)
- CIT Awards Committee (2001)
- Department Head Search Committee, MSE (2000)
- "Meeting of the Minds", Judge (2000)
- "Meeting of the Minds", Judge (1999)

Department

- Faculty Advisor, ASM Material Advantage Student Committee (2009-2011)
- Chair, Graduate Recruitment Committee (2006-2011)
- Chair, Departmental Seminar Committee (2006-2009)
- Undergraduate Curriculum Committee (2004-2011)
- Facilities Committee (2005-2006)
- Undergraduate Program Assessment and Review Committee (ABET) (2004-2005)
- GSAC Advisor (2003-2005)
- SAC Advisor (2000-2003)
- Undergraduate Affairs Committee (2001-2005)
- Graduate Affairs Committee (2001-2005)

Other

- Director of Outreach Activities, Mesoscale Interface Mapping Project (MIMP), Materials Research Science and Engineering Center (MRSEC), Carnegie Mellon University (2000)

SERVICE ACTIVITIES - LEHIGH

University

- Provost's Council (1998)
- Provost Search Committee (1996-97)
- Dean's Search Committee, Engineering and Applied Science (1994-95)
- Lehigh University Prestige Scholarship Committee (1992-1996)

College

- Engineering College Student Retention Committee

Department

- Search Committee, Loewy Chair, Department of Materials Science and Engineering (1996)
- Directed a $250,000 renovation effort for thin film processing, ceramic processing (clean room), thin film characterization and electrochemical processing laboratories (1993-95)
- Faculty Co-advisor of the Departmental Student Materials Society (1995-1998)
- Sigma Xi, Departmental officer

SERVICE ACTIVITIES - OTHER

23. Panel Member, NSF MRSEC pre-proposals, September 2022.

22. South Big Data Hub Workshop, Materials Microstructure Repositories and Registries, July 2021.

21. National Science Foundation Workshop to determine the direction of research for the Metals and Nanomaterials and the Condensed Matter Materials Theory programs of the Division of Materials Research, July 2021.

20. Judge, Tricounty Science Fair, April 2014.

19. Panel member, NSF SBIR/STTR grants, February 2014.

18. Session Chair, Magnetism and Magnetic Materials Conference, November 2010.

17. Materials Advantage Faculty Advisor (2009-2011).
Acted as advisor to the Material Advantage Student Committee of the professional materials societies ASM, ACers, and TMS, with particular assistance to organization of Young Members Night held in Feb. each year.

16. Panel member, NSF CAREER grants, October 2009.

15. Congressional Visit Day – Visiting the Staff of the Offices of Members of the House of Representatives and the Senate", March 4-5, 2008.

14. Chair, MO Physics and Devices II, MORIS, Pittsburgh, PA (2007).

13. Panel Member, Pre-proposals for Integrated Graduate Education and Research Program, NSF, June 2007.

12. Program Committee Member, 50th Annual Conference on Magnetism and Magnetic Materials 2005.

11. Judge, Graduate Student Award, Materials Research Society, April 2004.

10. Panel Member, NSF-EU grants, January 2004.

9. Panel member, NSF CAREER grants, October 2002.

8. Site Review Panel Member, Harvard University National Science Foundation Materials Research Science and Engineering Center (NSF MRSEC), Spring 2001.

7. Judge, Graduate Student Award, Materials Research Society, December 1997.

6. Reviewer, NSF CAREER grants, October 1997.

5. Panel member, NSF instrumentation grants, January 1997.

9. Panel member, NSF CAREER grants, January 1997.

4. Committee of Visitors, National Science Foundation (NSF), April 1996.

3. Panel member, NSF instrumentation grants, January 1995.

2. Judge, Lehigh Valley Science and Engineering Fair, March 1994.

1. Reviewer for:
NSF, DoE, CRDF, J. Magn. Mag. Mater., Metall. Transactions, Acta Mater., Applied Physics Letters, Thin Solid Films, J. Mater. Sci. Mater. Res. Bulletin, J. Vac. Sci. Technol, J. Phys., Mater. Sci. Eng., J. Electrochem. Soc., J. Appl. Phys., J. Alloys Compounds.

COLUMBIA ACCOMPLISHMENTS 2011-2019

Materials Science Program

During my six years (2013-2019) as Director of the Materials Science and Engineering Program in the Department of Applied Physics and Applied Mathematics, I successfully led the implementation of a new curriculum at both the undergraduate and graduate levels. The new curriculum includes two new hands-on laboratory courses for undergraduates and a new laboratory course for graduate students.

- Updated, **modern materials science curriculum** with stronger core and greater flexibility via choice of electives
- **11 new courses**: + Art of Engineering module on batteries

- MSAE E3010 and 3011 Foundations of Materials Science
- MSAE E3012 and 3013 Laboratory in Materials Science
- MSAE E4100 Crystallography (Barmak)
- MSAE E4102 Synthesis and Processing
- MSAE E4200 Theory of Crystalline Materials: Phonons
- MSAE E4201 Materials Thermodynamics and Phase Diagrams (Barmak)
- MSAE E4203 Theory of Crystalline Materials: Electrons
- MSAE E4260 Electrochemical Materials and Devices: From Structure to Performance
- MSAE E4301 Materials Science Laboratory
- MSAE E6100 Transmission Electron Microscopy (Barmak)

Additionally, I established the MSE laboratory as a shared user facility as well as serving a teaching facility for structural, microstructural and mechanical properties characterization of materials. I continue to lead the effort in bringing in new instruments into the facility. The facility description can be found at https://mseshared.apam.columbia.edu/.

- Upgraded teaching lab and established it as a general user facility
- Full time technical support staff
- New Instruments + existing instruments made operational
  - Grinders, polishers, mounting equipment, diamond saw, Hot press
  - Annealing furnaces, Arc melter
  - Several optical microscopes
  - Microindenter and hardness testers
  - Atomic force microscope
  - Instron Machines
  - X-ray diffractometer
  - Computers with materials software (CrystalMaker suite, ASM phase diagrams, X-ray diffraction data visualization and analysis software)
- Modern thin film X-ray Diffraction facility (– Instrument was delivered and installed in late 2019.

Materials Characterization Infrastructure

Since joining Columbia in 2011, I have established the central Electron Microscopy (EM) user facility, and a new thin films X-ray Diffraction Laboratory in the MSE program. The EM facility is now part of the Columbia Nano Initiative suite of user facilities and includes scanning and transmission electron microscopes in addition to instruments for sample preparation. I led the 6-year, $4 million effort on instrument purchase, room design and renovation and installation of a Talos F200X transmission electron microscope, in addition to the purchase of the scanning electron microscopes and sample preparation instruments. I have continued to contribute to the upgrade of the facilities, with the Columbia Talos being the first instrument of its kind in the world to have the NanoMEGAS precession electron diffraction system installed in April 2018. A link to the video showcasing the Talos F200X can be found on my webpage at https://apam.columbia.edu/katayun-barmak.

To train Columbia students in the theory and practice of transmission electron microscopy, I developed and teach the Transmission Electron Microscopy course. In addition to the classroom lectures, this course includes nine hands-on sessions on the Talos.

- Transmission Electron Microscopy (Barmak)
  - TEM/STEM Talos F200X (2015)
  - NanoMEGAS crystal orientation mapping system (2018)
  - Sample preparation instruments
- Scanning Electron Microscopes (Barmak)
  - FEI NanoNova 450 (clean room) (2015)
  - Zeiss Sigma (EM Facility) (2015)
- Energy Dispersive Spectrometry for Zeiss Sigma
- Electron back scatter diffraction system for Zeiss Sigma (Barmak) (2018)

TEACHING EXPERIENCE

Columbia University

MSAE E3100/E4100 *(New)*	Crystallography (F13, F14, F15, F16, F17, F18, F19, F20, F21, F22, S24, F24)
MSAE E4101	Structural Analysis of Materials (F13, F14)
MSAE E4215	Mechanical Behavior of Materials (S13, S14)
MSAE E3201/E4201 *(New)*	Materials Thermodynamics and Phase Diagrams (S16, S19, S20, S21, F23)
MSAE E6100 *(New)*	Transmission Electron Microscopy (S17, S19, S22)

Carnegie Mellon University

Undergraduate Courses

27-100	Materials in Engineering (F99, S00, F00, S05, S06)
27-202	Defects in Materials (F01, F03)
27-217	Phase Relations and Diagrams (S01, S07, S08, S09, S10)
27-302 *(New)*	Microstructure and Properties II (F03, F04, S06, S07)
27-530	Advanced Physical Metallurgy (S00)

Graduate Courses

27-780	Thermodynamics (F08)
27-799	Thermodynamics II (F09, F10)
39-610 *(New)*	Energy Conversion and Supply (F10)

Non-FCE Courses

27-401	Senior Design Class (Supervised student project)
27-774	Graduate Seminar (F06, S07, F07, S08, F08, S09)

Lehigh University

Undergraduate Courses

MAT33	Engineering Materials and Processes (S94, S95, S97, F97×2 (taught two sections), S98)

MAT216	Diffusion and Phase Transformations (F96, F97)
MAT312, ChE312, CHM312*(New)*	Fundamentals of Corrosion (S93, S95,S97)
MAT367, ChE367 *(New*)	Metal Films and Coatings: Processing, Structure, Properties (Co-taught with Chemical Eng.) (S94)

Graduate Courses

MAT401	Thermodynamics and Kinetics I (F93, F94, F95)
MAT412 *(New*)	Magnetic Properties of Materials (F93)

Laboratories

Renovated, set up and upgraded an undergraduate X-ray diffraction laboratory in Whitaker.

Short Courses and Other

Lehigh Microscopy Short Course	Scanning electron microscopy laboratories (S93, S94, S95, S96)
Guest lecture, Engineering 1 - (Undergraduate)	Engineering Computations (F96)
Guest lectures on thin film reactions MAT408 (Graduate)	Phase Transformations (F96)

For courses marked as "New", I developed a new course, which included notes, problem sets, examinations and team projects depending on the content of the course.

POST DOCTORAL ASSOCIATES	YEAR	UNIVERSITY
13. Kadir Sentosun	2018-2019	Columbia
12. Amirali Zangiabadi	2016-2017	Columbia
11. Nader Zaki	2015-2016	Columbia
10. Bincheng Wang	2011	Columbia
9. Shanling Wang	2006	CMU
8. Rumyana Petrova	2006-08	CMU
7. Jihwan Kim	2001-04	CMU
6. W. Scott Tong	2000	CMU
5. Gene Lucadamo	2000	Lehigh
4. Lisa Friedersdorf	1996-98	Lehigh
3. Guobin Zhang	1995	Lehigh
2. Saikumar Vivekanand	1994	Lehigh
1. Brian Smith	1993	Lehigh

GRADUATE STUDENTS

DOCTORAL STUDENTS	YEAR	UNIVERSITY
21. Katherine Lee	2029 (expected)	Columbia (APAM)
20. Luke Holtzman	2026 (expected)	Columbia (APAM)
19. Matthew Patrick	2025 (expected)	Columbia (APAM)
18. Ryan Gusley	2022	Columbia (ChemE)

Co-advisor with Prof. Alan West (Chemical Engineering)
Title: Electrodeposition of Epitaxial Metals for the Fabrication of Single Crystal Interconnects

18. Bumho Kim 2020 Columbia (MechE)
Co-advisor with Prof. James Hone (Mechanical Engineering)

Title: Improved optical and electrical properties of $MoSe_2$ and WSe_2 via reduction of point defects

17. Emily Hsu 2020 Columbia (EEE)
Co-advisor with Prof. Alissa Park (Earth and Environmental Engineering) and Prof. Alan West (Chemical Engineering)

16. Jeffrey Taylor 2018 Columbia (APAM)
Co-advisor with Prof. I. Cevdet Noyan (Applied Physics and Applied Mathematics)

15. Emi Leung 2016 Columbia (EEE)
Co-advisor with Prof. R. Farrauto (Earth and Environmental Engineering)
Title: Mechanistic Investigation of Novel Niobium-Based Materials as Enhanced Oxygen Storage Components and Innovative CO Oxidation Catalyst Support for Environmental Emission Control Systems

14. Jiaxing Liu 2016 Columbia(APAM)
Title: Deposition and Characterization of Magnetron Sputtered Beta-Tungsten Thin Films

13. Xuan Liu 2013 CMU
Title: Electron Diffraction-Based Metrology of Nanocrystalline Materials

12. Dooho Choi 2011 CMU
Title: Tungsten as a Next-generation Interconnect Metal in Semiconductor Devices

11. Amith Darbal 2011 CMU
Title: Surface and Grain Boundary Scattering in Nanometric Cu Films: A Quantitative Analysis including Intra-grain Boundaries

10. Bincheng Wang 2011 CMU
Title: Ultrahigh Density Magnetic Recording Media: Kinetic Experiments and Models of the A1 to $L1_0$ Phase Transformation in FePt and Related Ternary Alloy Films

9. David C. Berry 2007 CMU
Title: Ultrahigh Density Magnetic Recording Media: The A1 to $L1_0$ Phase Transformation in FePt and Related Ternary Alloy Films

8. Shu Zhang 2007 CMU(MechE)
Co-advisor with Prof. Mehdi Asheghi (Mechanical Engineering)
Title: Developing a device and technique for small scale calorimetry

7. Wayne Archibald 2004 CMU
Title: Microstructural Characterization of Al Thin Films and Foils: Grain Growth, Grain Boundary Topology and Statistics

6. Ali Gungor 2002 CMU

Title: Cu and Cu Alloy Thin Films: Evolution of Resistivity and Microstructure

5. Jihwan Kim 2001 Lehigh
Title: Magnetic Exchange Coupling in Hard/Soft Ferromagnetic Composite Thins Films of CoPt/Co: Role of Processing and Structure

4. Gene A. Lucadamo 2000 Lehigh
Title: A Study of the Kinetics and Microstructure Evolution during Reactions of Niobium/Aluminum and Titanium/Aluminum Multilayer Thin-Films

3. W. Scott Tong 2000 Lehigh
Co-Advisor with Prof. Jeffrey Rickman (Materials Science and Engineering)
Title: The effect of Heterogeneous Nucleation on Two Dimensional Phase Transformation Kinetics and Resultant Microstructure

2. Derrick T. Carpenter 1998 Lehigh
Title: Improvements in the Characterization of Polycrystalline Thin Films: Microchemistry, Microtexture, and Microstructure

1. Roger A. Ristau 1998 Lehigh
Title: Microstructural and Magnetic Characterization of CoPt and FePt Thin Films

MASTERS STUDENT SCIENCE REPORTS – COLUMBIA UNIVERSITY

24. Eric Yi Fall 2022, Spring, Summer 2023
X-ray diffraction and cross-sectional sample preparation of ruthenium/chromia heterostructures grown on sapphire(0001)

23. Dumasia, Zeenia Summer, Fall 2018
Darkening of Vermilion in 14th -16th Century Paintings and Illuminated Manuscripts

22. Michael Berkson, Fall 2017, Spring, Summer, 2018
Copper Pigment Degradation in Early European Printed Books

21. Jiaqi Huang Summer, Fall 2018
Characterization of Transition Metal Dichalcogenides

20. Baili Huang Spring, Summer, Fall 2018
Characterization of Transition Metal Dichalcogenides

19. Rui Zu Fall 2016, Spring, Fall 2017, Spring 2018
Characterization of Transition Metal Dichalcogenides

18. Anqi Qu Spring 2017

17. Xueyin Yang Spring 2017

16. Rong Deng	Spring, Fall 2016
15. Xiwen Chen	Spring, Summer, Fall 2016
14. Yunkai Sun	Spring, Summer, Fall 2016, Spring 2017
13. Peng Yue	Fall 2015
12. Qi Zhou	Fall 2015
11. Nadezhda Khapochkina	Spring, Summer 2015
10. Qiyuan Lin	Spring, Summer, Fall 2015
9. Fernando Concalves-Neto	Spring, Summer, Fall 2015
8. Wendi Cheng	Spring 2014
7. Haoming Lu	Spring 2014
6. Hao Duan	Spring 2014
5. Yiwei Jin	Fall 2013
4. Jingjing Ling	Fall 2013
3. Zhaoyi Li	Spring 2012
2. Ying Wang	Spring 2012
1. Yiran Lu	Spring 2012

MASTERS STUDENTS	**YEAR**	**UNIVERSITY**
17. Xuan Liu	2011	CMU
16. Bincheng Wang	2008	CMU
15. Vineet Kumar	2007	CMU
14. David C. Berry	2006	CMU
13. Sukbin Lee	2003	CMU
12. Iung-Hsin Hsieh	2003	CMU

11. Chando Park	2002	CMU
10. Srinivasan Kumar	2000	CMU
9. Hyungwook Kim	1999	CMU

MASTERS STUDENTS (with Thesis)	**YEAR**	**UNIVERSITY**

8. Balaji Gadicharla 1997 Lehigh
   Title: Processing and Characterization of Metallic Thin Films: Sputter Deposition, Substrate Temperature Calibration, Thickness Determination and Thermal Analysis

7. Douglas Puerta 1997 Lehigh

6. Gene A. Lucadamo 1996 Lehigh
   Title: A Study of Reactive Phase Formation in Sputter-Deposited Ni/Al Multilayer Thin Films

5. W. Scott Tong 1996 Lehigh
   Title: The effect of Heterogeneous Nucleation on Two Dimensional Phase Transformation Kinetics and Resultant Microstructure

4. Cindy M. Petronis 1996 Lehigh
   Title: Electrochemical Processing of Metal Matrix Composite Coatings

3. Ellen Youngblood 1995 Lehigh

2. Roger A. Ristau 1995 Lehigh
   Title: A Quantitative Study of Grain Growth in CoPt, Ni and NiFe Thin Films

1. Lance Muzslay 1994 Lehigh

UNDERGRADUATE STUDENTS	**YEAR**	**UNIVERSITY**

61. Ming Gong Fall 2024 Columbia
    Automated grain boundary detection in transmission electron micrographs
    Co-PI: Jeffrey Rickman (Lehigh Univ.)

60. Joshua Wade Fall 2024 Columbia
    Automated grain boundary detection in transmission electron micrographs
    Co-PI: Jeffrey Rickman (Lehigh Univ.)

59. Annie Jaswal Summer 2024 Colby College
    Synthesis of transition metal dichalcogenides

58. Alexandra Ermilova Spring 2024 Columbia
Automated grain boundary detection in transmission electron micrographs
Co-PI: Jeffrey Rickman (Lehigh Univ.)

57. Lauren Grae Spring 2024 Columbia
Automated grain boundary detection in transmission electron micrographs
Co-PI: Jeffrey Rickman (Lehigh Univ.)

56. Rosnel Alejandro Leyva-Cortes Jr. Spring 2024 Columbia
Automated grain boundary detection in transmission electron micrographs
Co-PI: Jeffrey Rickman (Lehigh Univ.)

55. Miguel Samuel Summer 2023 CCNY
Crystal growth kinetics of WSe_2 in a self-flux synthesis

54. Sylvia Whang Summer 2023, Fall 2024 Barnard
Automated Grain Boundary Detection in Transmission Electron Micrographs
Co-PI: Stacey Levine (Duquesne Univ.), Jeffrey Rickman (Lehigh Univ.)

53. Sarah Asher Spring 2023, Summer 2023 Columbia
Automated Grain Boundary Detection in Transmission Electron Micrographs
Co-PI: Stacey Levine (Duquesne Univ.), Jeffrey Rickman (Lehigh Univ.)

52. Trinh Hyun Summer 2022 UC, Berkeley
Optimizing the Mechanical Exfoliation of Transition Metal Dichalcogenides

51. Alan Ma Summer 2022 Columbia
Automated Grain Boundary Detection in Transmission Electron Micrographs
Co-PI: Stacey Levine (Duquesne Univ.)

50. David Roman Summer 2021 Lehman College
Point Defect Detection in Scanning Tunneling Microscopy Images of
Transition Metal Dichalcogenides using a Machine Learning Approach

49. Silvia Toderas Fall 2021-Spring 2022 Columbia
Automated Grain Boundary Detection in Transmission Electron Micrographs
Co-PI: Stacey Levine (Duquesne Univ.)

48. Javier Lopez Summer 2021-Spring 2022 Columbia
Automated Grain Boundary Detection in Transmission Electron Micrographs
Co-PI: Stacey Levine (Duquesne Univ.)

47. James Eckstein 2021-22 U. Utah and UIUC
Image Processing of Transmission Electron Micrographs
Co-PIs: Stacey Levine (Duquesne Univ.), Yekaterina Epshteyn (Univ. Utah)

46. Liam Hayes Srping 2020 Columbia
Image Processing of Transmission Electron Micrographs
Co-PIs: Stacey Levine (Duquesne Univ.), Yekaterina Epshteyn (Univ. Utah)

45. Lauren Kranis Spring 2020 Columbia
Microstructure and Mechanical Properties of Hypereutectoid Steel
Co-PI: Adrian Brugger (Carleton Lab)

44. Ruby Aidun 2019-20 Columbia
Copper Pigment and Paper Degradation in Early European Printed Books
CoPIs: Alexis Hagadorn, Emily Ford (Butler Laboratory)

43. Natasha Mohan 2019-20 Columbia
Copper Pigment and Paper Degradation in Early European Printed Books
CoPIs: Alexis Hagadorn, Emily Ford (Butler Library)

42. Benjamin McCaffrey 2018-19 Columbia
Grain size and Grain boundary Character Distribution of Al-Mn Films

41. Mehrzad Farnoosh 2018-19 Columbia
Grain Size and Grain Boundary Character Distribution of Al-Mn Films

40. Aren Small 2018-19 Columbia
Copper Pigment Degradation in Early European Printed Books

39. Maira Khan 2018 Harvard
Tight-Binding Conductivity Calculations of Nanometric Metal Interconnects
Co-Advisors: E. Mucciolo and P. Schelling (University of Central Florida)

38. Jacobi Peets Summer 2018 Univ. Virgin Islands
Preparation of Transmission Electron Microscopy Samples of Transition Metal Dichalcogenides

37. Drazan Medina Summer 2017 Columbia
Preparation of Transmission Electron Microscopy Samples of Transition Metal Dichalcogenides

36. Yinan Dong Spring 2017 Columbia
Preparation of Transmission Electron Microscopy Samples of Transition Metal Dichalcogenides

35. Michael Berkson 2016 Columbia
Grain Size and Grain Boundary Character Distribution of Al Films

34. Christina Floristean Summer 2014 Columbia
Order-disorder transformation kinetics of $FeNi_3$

33. Lauren Riddiford	Summer 2014, Fall 2014	Columbia
Order-disorder transformation kinetics of $FeNi_3$		
32. Sloka Gundala	2014	Columbia
31. David Schutzman	2011	CMU
30. Justin Dersh	2009	CMU
29. Andrew Jesanis	2009	CMU
28. Shannon Andersen	2008	FSU/CMU
27. Anthony Rice	2008	CMU
26. Alexander Hansen	2008	CMU
25. Scott Roberts	2007	CMU
24. Terry Shyu	2007-08	CMU
23. Hanness Eggenschwiller	2006	CMU/EPFL
22. Mitchell Kosowski	2006	CMU
21. Nelson Cheung	2006	CMU
20. Ysela Chiari	2005	FAMU/CMU
19. Benjamin Nowak	2005	CMU
18. Laura Pritchard	2004	CMU
17. Velouse Pierre	2004	FAMU/CMU
16. Wan Nurul Hanani Wan Alkamar Shah	2003	CMU
15. Ernestine Lowery	2002	FAMU/CMU
14. Lauren Casey	2002	FAMU/CMU
13. Autumn Wyda	2002	CMU
12. Antoine Beret	2000	FAMU/CMU

11. Mitra Taheri	1999	CMU
10. Mathew Walker	1999	Alfred/CMU
9. Michael Carone	1998	Lehigh
8. Sarah Phillips	1998	Lehigh
7. Joleen Codner	1996-1998	Lehigh
6. Richard Noecker	1996	Lehigh
5. Valerie Liu	1995	Rice/Lehigh
4. Shannon Reaney	1995	Lehigh
3. Megan Slusser	1995	Lehigh
2. Steven Banovic	1994	Lehigh
1. Kevin Johnson	1994	Lehigh

HIGH SCHOOL STUDENTS	**YEAR**
3. Anastasia Dunca	2021
2. Brian Medina	Summer 2017(MRSEC E.N.G.)
1. Steven French	Summer 2017(MRSEC E.N.G.)

E.N.G. = Engineering the Next Generation