Jeremy K. Mason

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RESEARCH INTERESTS

Microstructure evolution, texture analysis, grain boundary properties, molecular dynamics, statistical thermodynamics, statistical topology.

EDUCATION

9/05 – 6/09 **Massachusetts Institute of Technology**, Cambridge, MA, USA
Ph.D. in Materials Science and Engineering
Thesis – *Analysis of Crystallographic Texture Information by the Hyperspherical Harmonic Expansion*

9/01 – 6/05 **Massachusetts Institute of Technology**, Cambridge, MA, USA
B.S. in Physics
Thesis – *Statistical Physics of Dislocation Nucleation by Nanoindentation*

PROFESSIONAL EXPERIENCE

7/23 – Now **Associate Professor**, Department of Materials Science and Engineering, University of California, Davis, CA, USA

8/17 – 6/23 **Assistant Professor**, Department of Materials Science and Engineering, University of California, Davis, CA, USA

1/17 – 7/17 **Visiting Assistant Professor**, Department of Mathematics, The Ohio State University, Columbus, OH USA

9/16 – 12/16 **Visiting Assistant Professor**, Institute for Computational and Experimental Research in Mathematics, Brown University, Providence, RI, USA

8/13 – 12/16 **Assistant Professor**, Department of Mechanical Engineering, Boğaziçi University, Istanbul, TR

9/11 – 4/13 **Lawrence Fellow**, Advised by Mukul Kumar, Lawrence Livermore National Laboratory, Livermore, CA, USA

9/09 – 7/11 **Postdoctoral Scholar**, Advised by Prof. Robert D. MacPherson, Institute for Advanced Study, Princeton, NJ, USA

9/05 – 6/09 **Graduate Researcher**, Advised by Prof. Christopher A. Schuh, Massachusetts Institute of Technology, Cambridge, MA, USA

TEACHING EXPERIENCE

Department of Materials Science and Engineering, University of California, Davis

22/23 W
21/22 W
20/21 W
Advanced Mechanical Properties of Materials (EMS 274): Graduate course that provides students with a comprehensive background about the mechanical properties of materials, with some emphasis on dislocations and deformation and fracture control mechanisms.

23/24 F
22/23 F
Transport Phenomena in Materials Processes (EMS 264): Graduate course that introduces the thermodynamic driving forces and atomic-scale mechanisms underlying diffusive mass transport and interface motion in materials, with applications to the initiation and progress of phase transformations.

21/22 S
19/20 S
17/18 S
Computational Materials Science (EMS 285): Graduate course that introduces students to the capabilities and limitations of modern computational materials science methods, and gives some practical experience in their implementation and use.

21/22 F
20/21 F
19/20 W
18/19 S
Davis Likes Bikes (FRS 003/004): First year seminar where students learn about the history and engineering of bicycles, investigate the property requirements of different components (such as the wheel and frame), and relate these requirements to the materials of which they are made. No background in science or engineering is required.

20/21 S
18/19 S
Mechanical Behavior of Materials (EMS 174): Undergraduate course where students develop an understanding of the microstructural mechanisms that control the macroscopic properties of materials.

20/21 W
Materials Science and Engineering Seminar (EMS 290): Intended for graduate students in materials science and engineering, or those interested in materials science and engineering topics, to learn about advanced research in the field from distinguished scholars from peer institutions.

19/20 S
18/19 W
How Things Work (ENG 10): Undergraduate course that provides an introduction to the physical principles that enable technology encountered in everyday life. The intention is to help students learn what the world looks like from the perspective of an engineer.

17/18 S
Introduction to Computers (ECS 15): Undergraduate course that explores computer uses in modern society, with emphasis on uses in nonscientific disciplines. Includes word processing, spreadsheets, web-page creation, elementary programming, basic computer organization, and the Internet.

Department of Mathematics, The Ohio State University

16/17-2
Linear Algebra (MATH 2568): Undergraduate course on matrix algebra, vector spaces and linear maps, bases and dimension, eigenvalues and eigenvectors.

Department of Mechanical Engineering, Boğaziçi University

15/16-2
14/15-2
Advanced Engineering Mathematics II (ME 502): Graduate course on partial differential equations, the Laplace, diffusion, and wave equations, integral equations, functions of a complex variable, conformal mapping, complex integral calculus and the residue theorem.

15/16-2
14/15-2
Graduate Seminar (ME 579): Graduate course that widens students' perspectives and awareness of topics of interest to mechanical engineers through seminars offered by faculty, guest speakers and graduate students.

15/16-2
14/15-1,2
13/14-1
Materials Science (ME 210): Undergraduate course on materials and properties, atomic bonding and arrangements, structural imperfections, atom movements, deformation of materials, physical properties, modifying properties through structural changes, and nonmetallic materials.

15/16-1
14/15-1
Introduction to Computational Materials Science (ME 58F): Graduate course that introduces students to the capabilities and limitations of modern computational materials science methods, and gives some practical experience in their implementation and use.

15/16-1
13/14-2
Physical Metallurgy (ME 316): Undergraduate course on the description of crystals, structure determination, thermodynamics of crystals, diffusion, recovery, recrystallization, grain growth, phase transformations, and nucleation and growth.

Department of Materials Science and Engineering, Massachusetts Institute of Technology

08/09-2
Mechanical Behavior of Materials (3.22): Teaching assistant for graduate course on how the macroscale mechanical behavior of materials originates from fundamental, microscale mechanisms of elastic and inelastic deformation.

04/05-1
03/04-1
02/03-1
Introduction to Solid State Chemistry (3.091): Teaching assistant for undergraduate course on the basic principles of chemistry, electronic structure, chemical bonding, atomic arrangements, chemical kinetics, and phase diagrams.

HONORS AND AWARDS – Past Five Years

22 Outstanding Faculty Teaching Award, College of Engineering, UC Davis
21 Graduate Program Advising and Mentoring Award, Graduate Studies, UC Davis
21, 19, 18 Certificate of Excellence in Reviewing, Acta Materialia
21 Outstanding Reviewer, Modelling and Simulation in Materials Science and Engineering
20 Hellman Fellowship Award, UC Davis

20 Outstanding Faculty Teaching Award, College of Engineering, UC Davis
20 Institute of Physics Trusted Reviewer, Institute of Physics
19 Instructor of the Year Award, Materials Science and Engineering, UC Davis

GRANTS – Past Three Years

9/22 – 8/24 **Collaborative Research: EAGER: ADAPT: Charting the Space of Material Microstructures with Artificial Intelligence**
PI for NSF DMR, Award No 2232968. Amount awarded $106,769.
Support one student to develop metrics that rigorously quantify the difference between material microstructures, and to use them to construct a proof-of-concept universal materials database.

7/20 – 6/23 **Experimental and Computational Study of Pore Morphology Evolution Mechanisms in Nanoporous Metal Thin Films Under Thermal/Electrical/Mechanical Stress Fields**
Co-PI for NSF DMR, Award No 2003849. Amount awarded $481,403, Co-PI's share about $240,000.
Support one student to integrate electromigration and Joule heating into molecular dynamics simulations, and to evaluate the effect of these on the morphology evolution of nanoporous gold.

7/20 – 6/21 **Advancing Scientific Careers to Enhance Nuclear Technologies (ASCENT)**
Co-I with J. G. Gibeling (PI) for Nuclear Regulatory Commission. Amount awarded $50,000.
Support one student to investigate radiation damage accumulation in metals using molecular dynamics simulations of Frenkel pair insertion.

10/18 – 9/22 **TRIPODS+X: RES: Collaborative Research: Thermodynamic phases and configuration space topology**
PI for NSF TRIPODS Program, Award No 1839370. Amount awarded $300,000.
Support one student to study the possibility that phase transitions are a result of changes to the topology and geometry of the configuration space, using hard disks for the model systems.

PUBLICATIONS – Past Five Years

Refereed Journal Publications

1. Winkeljohn, C.M., Shahriar, S., Seker, E., and Mason, J.K. “Simulated surface diffusion in nanoporous gold and its dependence on surface curvature” *Computational Materials Science*, 2023; 230: 112430.
2. Kapan, E., Alkan, S., Aydiner, C.C., and Mason, J.K. “Energetic contributions to deformation twinning in magnesium” *Modelling and Simulation in Materials Science and Engineering*, 2023; 31: 075002.
3. Ericok, O.B., and Mason, J.K. “Geometric conjecture about phase transitions” *Physical Review E*, 2023; 107:064107.
4. Sotelo Martin, L.E., O’Shea, N.M., Mason, J.K., and Castro, R.H.R. “Designed Y3+ surface segregation increases stability of nanocrystalline zinc aluminate” *The Journal of Physical Chemistry C*, 2023; 127:4239.
5. Stimac, J.C., Serrao, C., and Mason, J.K. “Dependence of simulated radiation damage on crystal structure and atomic misfit in metals”. *Journal of Nuclear Materials*, 2023; 585:154633.
6. Stimac, J.C., Bertin, N., Mason, J.K., and Bulatov, V.V. “Energy storage under high-rate compression of single crystal tantalum” *Acta Materialia*, 2022; 239:118253.
7. Eren, E., Runnels, B., and Mason, J.K. “Comparison of evolving interfaces, triple points, and quadruple points for discrete and diffuse interface methods” *Computational Materials Science*, 2022;213:111632.
8. Ericok, O.B., and Mason, J.K. “Foundations of a finite non-equilibrium statistical thermodynamics: Extrinsic quantities” *Journal of Physics A: Mathematical and Theoretical*, 2022;55:295002.
9. Sasaki, D.Y., Chopdekar, R.V., Retterer, S.T., Jiang, D.Y., Mason, J.K., Lee, M.S., and Takamura, Y. “Formation of Complex Spin Textures in Thermally Demagnetized $La_{0.7}Sr_{0.3}MnO_3$ Artificial-Spin-Ice Structures” *Physical Review Applied*, 2022;17:064057.
10. Eriçok, O.B., and Mason, J.K. “Quotient maps and configuration spaces of hard disks” *Granular Matter*, 2022;24:1.
11. Eriçok, O.B., Ganesan, K., and Mason, J.K. “Configuration spaces of hard spheres” *Physical Review E*, 2021;104:055304.
12. Eren, E., and Mason, J.K. “Constant of motion for ideal grain growth in three dimensions” *Physical Review B*, 2021;104:L140103.

13. Eren, E., and Mason, J.K. “Topological transitions during grain growth on a finite element mesh” *Physical Review Materials*, 2021;5:103802.
14. Kawano, S., and Mason, J.K. “Classification of atomic environments via the Gromov-Wasserstein distance” *Computational Materials Science*, 2021;188:110144.
15. Lazar, E.A., Mason, J.K., MacPherson, R.D., and Srolovitz, D.J. “Distribution of topological types in grain-growth microstructures” *Physical Review Letters*, 2020;125:015501.
16. Schweinhart, B., Rodney, D., and Mason, J.K. “Statistical topology of bond networks with applications to silica” *Physical Review E* 2020;101:052312.
17. Kocer, E., Mason, J.K., and Ertürk, H. “Continuous and optimally complete description of chemical environments using Spherical Bessel descriptors” *AIP Advances* 2020;10:015021.
18. Kocer, E., Mason, J.K., and Ertürk, H. “A novel approach to describe chemical environments in high-dimensional neural network potentials” *The Journal of Chemical Physics* 2019;150:154102.
19. Sen., S. and Mason, J. “Topological constraint theory for network glasses and glass-forming liquids: A rigid polytope approach” *Frontiers in Materials* 2019;6:213.
20. Akiner, T., Kocer, E., Mason, J.K., and Ertürk, H. “Green–Kubo assessments of thermal transport in nanocolloids based on interfacial effects” *Materials Today Communications* 2019;20:100533.

INVITED TALKS

2022 Mason, J.K., and Eriçok, O.B. “Topology of phase transitions”. Applied Topology in Bedlewo, Bedlewo, PL.

2021 Mason, J.K. “Computational materials design, realistic microstructures, and grain boundary faceting”. University of Illinois at Urbana-Champaign, Mechanical Science and Engineering, Department Seminar, Virtual.

2021 Mason, J.K., and Kawano, S. “Comparing local atomic environments by the Gromov-Wassertein distance”. SIAM Conference on Mathematical Aspects of Materials Science, Virtual.

2020 Mason, J.K., and Eriçok, O.B. “Geometry of a phase transition”. Foundations of Computational Mathematics, Vancouver, CA (canceled due to COVID-19).

2020 Mason, J.K., and Eriçok, O.B. “Geometry of a phase transition”. SIAM Conference on Mathematical Aspects of Materials Science, Bilbao, ES (canceled due to COVID-19).

2019 Mason, J.K., and Eren, E. “Microstructure stabilization and the Herring condition”. University of Colorado, Mechanical and Aerospace Engineering, Department Seminar, Colorado Springs, CO.

2019 Mason, J.K., Eriçok, O.B., and Ganesan, K. “Geometry of a phase transition”. TGDA@OSU TRIPODS Center Workshop: Structure in the Micro-world, Columbus, OH.

2019 Mason, J.K., and Eren, E. “Microstructure stabilization and the Herring condition”. TMS Annual Meeting & Exhibition, San Antonio, TX.

2018 Mason, J.K., and Eren, E. “Microstructure stabilization and the Herring condition”. Multiscale Materials Modeling, Osaka, JP.

2018 Mason, J.K. “Predictive simulations of grain structure evolution”. Mathematical Sciences Research Institute: Shape and Structure of Materials, Berkley, CA.