

Zachary Morgan

Computational Instrument Scientist
Oak Ridge National Laboratory
Neutron Scattering Division
Diffraction Section
Single Crystal Diffraction Group

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Appointments

R&D Associate Staff Member, Oak Ridge Nat'l. Lab. Sep 2020—Present

Education

PhD, Materials Science and Engineering, Michigan Tech. Univ. Aug 2020

- “Multiphysics Phase Field Modeling of Electromigration.”

BS, Mechanical Engineering, Michigan Technological University May 2015

- Summa cum laude

Research

Graduate research in neutron single crystal diffraction at ORNL Apr 2018—Present

- Developed computer programs for peak fitting and the analysis of diffuse neutron scattering from single crystals with correlated disorder (mentor: Dr. F. Ye)

PhD research in computational materials science at MTU Aug 2015—Present

- Developed a multiphysics computer program package for phase field modeling of microstructure evolution involving electromigration (advisor: Dr. Y.M. Jin)

Internships

Modeling Engineer, ThermoAnalytics, Inc. Jan 2015—Aug 2015

- Developed graphical tool for visualization and data extraction

Manufacturing Engineer, General Motors, Co. May 2012—Aug 2012

- Developed workflow tool for communicating tasks in tool and die production

Laboratory Technician, Cannon Muskegon, Corp. May 2011—Aug 2011

- Developed database tool for magnesium evaporation in superalloy production

Training

International Workshop on Hysteresis

- Magnetocaloric, Electrocaloric and Elastocaloric Refrigeration, Dresden, Germany ... Feb 2017

International Institute for Multifunctional Materials for Energy Conversion

- Summer School on Computational Materials Science, College Station, TX Jul 2016

San Diego Supercomputer Center Summer Institute

- Discover Big Data, San Diego, CA Aug 2013

Teaching, Mentoring, and Coaching

Instructor, Introduction to Materials Science and Engineering—Part 2 Oct 2019—May 2020

- Instruct recitations and computer laboratory sessions, 5 weeks per semester

Head Coach, Houghton Middle School math team Oct 2019—Present

- Once a week, 1 ½ hours per practice

Teaching Assistant, Transport Phenomena Jan 2016—Present

- Instruct computational laboratory sessions, spring semesters

Volunteer Coach, Materials Science and Engineering learning center Oct 2015—May 2017

- Twice a week, 2 hours per session

Assistant Coach, Houghton Middle and High School math teams Sep 2015—May 2019

- Once a week, 1 ½ hours per practice, 2018—2019

- Twice a week, 1 ½ hours per practice 2015—2018

Volunteer Coach, Transport Phenomena help session Jan 2013—Apr 2015

- Once a week, 2 hours per session, spring semesters

Fellowships, Awards, and Scholarships

External

- National Science Foundation Graduate Research Fellowship May 2016—Present
- Michigan Space Grant Consortium Fellowship May 2013—Apr 2014

Internal

- Doctoral Finishing Fellowship Jan 2020 — May 2020
- Outstanding Scholarship Award Apr 2020
- Professional Development Award for best graduate seminar presentation—fall Dec 2018
- Summer Undergraduate Research Fellowship May 2014—Aug 2014
- McArthur Research Internship Sep 2012—Apr 2014
- Materials Science and Engineering Departmental Scholar Sep 2013—Apr 2014
- Outstanding Academic Achievement: Multivariable Calculus Jan 2011—Apr 2011
- Jane and Fred Mayer Memorial Scholarship Sep 2013—Apr 2014
- Ladish Company Foundation Scholarship Sep 2012—Apr 2013
- James & Alma Van Camp Family Endowment Scholarship Sep 2012—Apr 2013
- Hale Family Memorial Endowment Scholarship Sep 2012—May 2015
- Mr & Mrs Ernest W. Kitzner Scholarship Aug 2011—May 2015
- Michigan Competitive Scholarship Aug 2011—Apr 2014
- Presidential Excellence Scholarship Aug 2010—Apr 2014

Publications

- Ye, F.; Morgan, Z.; Tian, W.; Chi, S.; Wang, X.; Manley, M. E.; Parker, D.; Khan, M. A.; Mitchell, J. F.; Fishman, R. Canted Antiferromagnetic Order and Spin Dynamics in the Honeycomb-Lattice Tb₂Ir₃Ga₉. arXiv:2103.03157 [cond-mat] 2021.
- Morgan, Z. J.; Jin, Y. M. Phase Field Modeling of Pore Electromigration in Anisotropic Conducting Polycrystals. Computational Materials Science 2020, 172, 109362.

Professional Societies

- Member, The Minerals, Metals, & Materials Society Jan 2021—Present

Presentations, Posters, and Reports

Presentations

- The Minerals, Metals & Materials Society 2020 Conference Mar 2021
 - "A refinement program to characterize single crystal magnetic diffuse scattering from neutron diffraction experiments"
 - "Modeling and simulation of stress gradient driven migration"
- American Crystallographic Association Jul 2021
 - Introduction to Diffuse Scattering Analysis from Single Crystal Neutron Diffraction Workshop
 - *Invited*, "A reverse Monte Carlo refinement Python program for the analysis of diffuse neutron scattering from single crystals"
- The Minerals, Metals & Materials Society 2020 Conference, San Diego, CA Feb 2020
 - "Modeling and simulation of pore electromigration in tin solders"
- Diffuse Scattering Interest Group Seminar, Oak Ridge National Laboratory Sep 2019
 - "A reverse Monte Carlo refinement program for diffuse single crystal neutron scattering data"
- First Integrated Workshop on Neutron Diffuse Scattering from Single Crystals, ORNL . Jun 2019
 - "A reverse Monte Carlo refinement Python program for the analysis of single crystal neutron scattering data"
- The Minerals, Metals & Materials Society 2019 Conference, San Antonio, TX Mar 2019
 - "Microelasticity modeling of defects and their role in the performance of tin solder interconnects"
- Materials Science and Engineering Department Seminar Sep 2018

- "Development of a reverse Monte Carlo refinement program for the analysis of magnetic diffuse neutron scattering data"
- The Minerals, Metals & Materials Society 2018 Conference, Phoenix, AZ Mar 2018
 - "The role of inhomogeneous properties on tin solder electromigration performance"
- Materials Science & Technology 2017 Conference, Pittsburgh, PA Oct 2017
 - "Effects of anisotropic properties on electromigration in tin solder interconnects"
- Materials Science and Engineering Department Seminar Mar 2017
 - "A partial differential equation solver: modeling materials processes with the continuum assumption"
- Materials Science & Technology 2016 Conference, Salt Lake City, UT Oct 2016
 - "Coupled charge conduction and mass diffusion in solder interconnects"
 - "Temperature dependent damping properties of ferroelectric ceramic-reinforced metal-matrix composites"
- Materials Science & Technology 2014 Conference, Pittsburgh, PA Oct 2014
 - "Damping mechanisms in ferroelectric ceramic-reinforced metal matrix composites"
- McArthur Research Internship Presentation Jan 2014
 - "Modeling and simulation of ferroelectric barium titanate for improving damping capabilities in metal matrix composites"
- McArthur Research Internship Presentation Jan 2013
 - "Phase field modeling of composites with functionally active materials"

Posters

- Materials Research Society Fall Meetings & Exhibits, Boston, MA Dec 2019
 - "Modeling and simulation of pore migration in tin solders at high homologous temperatures subjected to large electric currents and stress gradients"
- International Mechanical Engineering Congress and Exposition, Pittsburgh, PA Nov 2018
 - "Microelasticity modeling of microstructures"

Service

External Advisory Board, Michigan Tech. Univ. Mat'ls Sci. & Eng. Dept. Apr 2021–Present

Allocations

XSEDE Allocations

- Phase field modeling of defect migration" Dec 2018–Dec 2019
- Charge conduction, mass diffusion, and microstructure evolution in copper-tin solder interconnects" Jun 2017–Jun 2018

Programming Languages

C/C++, Fortran, Python

Leadership

Treasurer, Pi Tau Sigma—Michigan Tech Sigma Iota May 2013–Apr 2015

- International Mechanical Engineering Honor Society

Officer, Tau Beta Pi—Michigan Beta May 2014–Apr 2015

- The Engineering Honor Society

Secretary, Materials United May 2012–Apr 2014

- Material Advantage and American Foundry Society, Michigan Tech student chapter

President, Materials United May 2011–Apr 2012

- Material Advantage and American Foundry Society, Michigan Tech student chapter

Knowledge Dissemination

Congressional Visits Day 2012, Washington, DC Apr 2012

- Spoke to Michigan congressmen about the "Materials Genome Initiative"