

AERIEL D. MURPHY-LEONARD

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140 W. 19th Ave • Columbus OH, 43210

EDUCATION

UNIVERSITY OF MICHIGAN

ANN ARBOR, MI

Ph.D. in Materials Science & Engineering, November 2018

M.S. in Materials Science & Engineering, August 2016, GPA: 4.0/4.0

- Specialization: Physical & Mechanical Metallurgy

UNIVERSITY OF ALABAMA

TUSCALOOSA, AL

B.S. in Metallurgical Engineering, December 2012, GPA: 3.9/4.0

EXPERIENCE

PRESENT

ASSISTANT PROFESSOR, THE OHIO STATE UNIVERSITY

COLUMBUS, OH

- Combining advanced characterization with in-situ experiments to quantify relationships between manufacturing/processing, micro/macro structures, and mechanical behavior in microstructurally and compositionally complex alloy systems, additive manufactured materials, and magnesium alloys.

2019-2021

NRC POSTDOCTORAL FELLOW, NAVAL RESEARCH LABORATORY WASHINGTON DC

- Determined that porosity is in-homogeneously distributed near the surface in thin walled additively manufactured stainless steel using x-ray microcomputed tomography (μ XCT)
- Used in-situ (μ XCT to investigate the role of porosity in crack initiation of additively manufactured materials during cyclic and monotonic loading.
- Characterized pitting corrosion during mechanical loading of additively manufactured materials using in-situ μ XCT

2013-2019

GRADUATE RESEARCH ASSISTANT, UNIV. OF MICHIGAN

ANN ARBOR, MI

Analysis of the Effect of Alloying, Grain-Size, and Temperature on Recrystallization and Grain Growth Behavior in Magnesium

- Demonstrated using crystallographic orientation information from Scanning Electron Microscopy (SEM) and Electron Back Scatter Diffraction (EBSD) that twin boundaries were favored nucleation sites during recrystallization of unalloyed-Mg and a Mg-Al alloy
- Developed a mathematical relationship to determine the activation energy for recrystallization in unalloyed Mg and a Mg-Al alloy
- Determined that two stages of recrystallization exist during annealing of Mg: First at high stored energy grain and twin boundaries and secondly at low strain energy grain interiors

Understanding the Influence of Grain-Size and Alloying on Cyclic Stress Strain Behavior and Low Cycle Fatigue Behavior of Mg and Mg alloys

- Determined that an increase in twin volume fraction in a Mg-Al alloy when compared to unalloyed Mg reduced the fatigue life of the Mg-Al alloy
- Discovered that both the twin initiation stress and the detwinning exhaustion stress was independent of grain size and Al addition in magnesium
- Used EBSD to show that twinning and detwinning occur alternately during fully reversed low cycle fatigue of magnesium and that residual twins remain in the material after successive loading

Synchrotron Characterization of Twinning-Detwinning Behavior in Magnesium

- Utilized a novel combination of the synchrotron source and low-cycle fatigue to study the in-situ development of twinning and detwinning during cyclic loading at the Cornell High Energy Synchrotron Source (CHESS)
- Determined that the twin volume fraction was more than doubled in a Mg-Al alloy when compared to unalloyed Mg
- Learned that the detwinning exhaustion stress was related to the twin volume fraction and was independent of grain size and alloying.

2012-2013

RESEARCH ENGINEER INTERN, ALSTOM INC.

CHATTANOOGA, TN

- Designed and built laboratory equipment to study the corrosion resistance of coatings developed by Alstom Inc.
- Developed experiments to study oxidation and corrosion behavior of coatings such as salt immersion experiments, heat-treatments, and bond strength analysis
- Performed optical analysis of specimen surfaces using Scanning Electron Microscopy and Optical Microscopy
- Wrote technical reports on collected data and results

2012

UNDERGRADUATE RESEARCH ASSISTANT, UNIV. OF MICHIGAN ANN ARBOR, MI

- Used Scanning Electron Microscopy to characterize discontinuous and continuous precipitation in Mg alloy AZ91
- Determined the influence of solution treatment on precipitation morphology in Mg alloy AZ91
- Measured the hardness of different samples based in ageing time and precipitate size

2009-2011

RESEARCH ENGINEER CO-OP, SOUTHERN COMPANY

BIRMINGHAM, AL

- Performed failure analysis on power plant components to determine failure modes
- Analyzed failed components using scanning electron microscopy, optical microscopy, mechanical testing, and non-destructive examinations
- Prepared test specimen using standard metallographic techniques
- Prepared technical reports and presentations

**TEACHING
EXPERIENCE**

THE OHIO STATE UNIVERSITY

- MATSCEN 5763: Fatigue & Fracture Mechanics, Autumn: 2022, 2023
- MATSCEN 6765: Mechanical Behavior of Materials, Spring: 2021, 2022, 2024
- MATSCEN 7895: Graduate Seminar, Autumn 2021, Spring 2022

GRADUATE STUDENT INSTRUCTOR-MATERIALS LAB I

- Assisted with the development of a curriculum and laboratory manual for a sophomore/junior level laboratory course at the University of Michigan
- Facilitated and instructed bi-weekly lab-based courses
- Performed weekly lectures based on materials science concepts
- Instructed computer-programming based lectures to students

CENTER FOR ENGINEERING DIVERSITY AND OUTREACH-SUMMER ENGINEERING ACADEMY

- *Engineering Concepts Instructor:* Developed and taught (3-yrs) a curriculum for the Summer College Engineering Exposure Program for rising high school seniors at UofM focused on the National Academy of Engineering Grand Challenges

LEADERSHIP & SERVICE

SOCIETY OF WOMEN ENGINEERS- THE OHIO STATE UNIVERSITY UNDERGRADUATE CHAPTER

- Co-advisor, 2022-Present

THE MINERALS, METALS, AND MATERIALS SOCIETY (TMS)

- Chair, Specialty Congress: Accelerating Discovery for Mechanical Behavior of Materials 2024, 2023-Present
- Member, Steering Committee, Specialty Congress, 2023-Present
- Chair, Magnesium Committee, 2023-2024
- Membership Diversity & Development Committee, Light Metals Division Representative, 2021-2024
- Chair, Fourth Summit on Diversity in Minerals, Metals, and Materials Profession, 2019-2022
- Member, Diversity, Equity, and Inclusion Committee
- Member, Mechanical Behavior Committee

EXPLORING OUR WORLD THROUGH MATERIALS SCIENCE WORKSHOP

- Served as Co-organizer of the Workshop
- Organized and implemented a 2-day workshop for undergraduate students at Alabama State University to explore the field of materials science and engineering

PHYSICAL METALLURGY GORDON RESEARCH SEMINAR

- Served as co-chair of the 2019 Physical Metallurgy Gordon Research Seminar
- Designed and implemented a conference schedule including poster and oral presentations for 70+ attendees
- Facilitated a mentoring session with senior level scientists and engineers and early career graduate and post-doctoral students

LIBERIA SOCIETY OF WOMEN ENGINEERS

- Planned and facilitated a 2 two-week leadership camps for 40+ female engineering students in Liberia, Africa (2-yrs)
- Successfully raised over \$60,000 through grants from the National Science Foundation (3-yrs)
- Designed and implemented a curriculum focused on materials science concepts for the University of Liberia in Monrovia, Liberia (2-yrs)

AWARDS

- National Science Foundation CAREER Award, 2023
- Department of Energy Early Career Award, 2022
- The Office of Naval Research Young Investigator Program Award, 2021
- The Minerals, Metals, and Materials Society, Structural Materials Division, Young Leaders Professional Development Award, 2020
- Physical Metallurgy Gordon Research Conference, Poster Award Winner, 2019
- Univ. of Mich. MLK Jr. Spirit Award Recipient, 2018

- Univ. Of Mich. Susan A. Lipschutz Award Recipient, 2018
- Univ. Of Mich. Richard and Eleanor A. Towner Prize for Distinguished Academic Achievement, 2018
- Univ. Of Mich. Willie Hobbs Moore Achievement Award, 2018
- Univ. Of Mich. Edward A. Bouchet Honor Society Inductee 2017
- Univ. Of Mich. Materials Sci. & Eng. Symposium Student Poster-Silver Award Winner, 2017
- Minerals, Metals, & Materials Society, Fatigue Symposium Poster Winner, 2017
- Univ. of Mich. Marian Sarah Parker Prize Recipient, 2016
- Recrystallization and Grain Growth Conference Student Research Award, 2016
- Univ. of Mich. MLK Jr. Spirit Award Recipient, 2016
- Univ. of Mich. Distinguished Leadership Award, 2015
- National Science Foundation Fellowship, 2013
- Univ. of Mich. Rackham Merit Fellow, 2013
- Minerals, Metals, & Materials Society Light Metals Division Undergraduate Scholarship Recipient, 2013
- ASM William & Mary Dyrkacz Scholarship Recipient, 2013
- Minerals, Metals, and Materials Society Light Metals Division Student Poster Winner, 2012
- Materials Science & Technology Student Poster Winner, 2012
- Univ. of Al. Metallurgical and Materials Engineering Outstanding Senior Award, 2012
- Univ. of Al. Randall Outstanding Undergraduate Research Award, 2012
- Univ. of Al. John C. Wilkins Excellence Award, 2011
- UNCF-Merck Fellow, 2011

JOURNAL PUBLICATIONS

A. Murphy-Leonard, V. Mazánová, Uncovering dislocation-precipitate interactions during tensile loading of wire arc additive manufactured nickel-aluminum-bronze. MRS Communications (2023). <https://doi.org/10.1557/s43579-023-00396-5>

M. Yaghoobi, Z. Chen, **A. Murphy-Leonard**, S. Daly, J. Allison, Deformation twinning and detwinning in extruded Mg-4Al: In-situ experiment and crystal plasticity simulation. Int. J. Plast. 155, 103345 (2022)

A. Murphy-Leonard, D. Pagan, P. Callahan, Z. Heinkel, C. Jaisen, D. Rowenhorst Investigation of Porosity, Texture, and Deformation Behavior Using High Energy X-rays During In-Situ Tensile Loading in Additively Manufactured 316L Stainless Steel Materials Science and Engineering A (2021) <https://doi.org/10.1016/j.msea.2021.141034>

D. Rowenhorst, L. Ngyuen, **A. Murphy-Leonard**, R.W. Fonda, Characterization of Microstructure In Additively Manufactured 316L Using Automated Serial Sectioning Current Opinion in Solid State and Materials Science 24 (3) <https://doi.org/10.1016/j.cossms.2020.100819>

A. Murphy-Leonard, D. Pagan, A. Beaudoin, M. Miller, J. Allison, Quantification of Twinning-Detwinning Behavior During Low-Cycle Fatigue of Pure Magnesium Using High Energy X-Ray Diffraction, *International Journal of Fatigue* 125 (2019) pp 314-323 <https://doi.org/10.1016/j.ijfatigue.2019.04.011>

A. Murphy, J. Allison, The Recrystallization Behavior of Unalloyed Mg and Mg-4%Al, *Metallurgical and Materials Transactions A*, 49 (2018) pp 1492-1508 <https://link.springer.com/article/10.1007/s11661-018-4494-6>

A. Murphy, Carli Huber, J. Allison, Grain Growth Behavior of Pure Mg and Mg-4Al, *Magnesium 2018: Proceedings of the 11th International Conference on Magnesium Alloys and Their Applications* (2018)

LK Aagesen, JF Adams, JE Allison, WB Andrews, V Araullo-Peters, T Berman, Z Chen, S Daly, S Das, S DeWitt, S Ganesan, K Garikipati, V Gavini, A Githens, M Hedstrom, Z Huang, HV Jagadish, JW Jones, J Luce, EA Marquis, A Misra, D Montiel, P Motamarri, **AD Murphy**, AR Natarajan, S Panwar, B Puchala, L Qi, S Rudraraju, K Sagiyama, ELS Solomon, V Sundararaghavan, G Tarcea, GH Teichert, JC Thomas, K Thornton, A Van der Ven, Z Wang, T Weymouth, C Yang, PRISMS: An Integrated, Open-Source Framework For Accelerating Predictive Structural Materials Science, *JOM* 70 (10), pp 2298-2314, <https://doi.org/10.1007/s11837-018-3079-6>

A. Murphy-Leonard, J. Allison, The Effect of Grain Size and Alloying On The Low-Cycle Fatigue Behavior of Magnesium. In Preparation

A. Murphy-Leonard, J. Allison, The Influence of Aluminum Addition on Twinning-Detwinning During Low Cycle Fatigue In Magnesium Using High Energy X-Ray Diffraction. In Preparation

G. Poole, N. Rimkus, **A. Murphy**, P. Boehmcke, N. El-Kaddah. Effect of the Solidification Rate on Microstructure of Cast Mg Alloys at Low Superheat. *Magnesium Technology 2012*. John Wiley & Sons, Inc., Hoboken, NJ, <http://onlinelibrary.wiley.com/doi/10.1002/9781118359228.ch30/summary>

A. Murphy, D. Leung. Nanotechnology For Drug Formulation: Improving Solubility of Insoluble Drugs. *AIP Conference Proceedings*. American Institute of Physics, Ste. 1 NO 1 Melville NY 11747-4502 United States, 2012.

PRESENTATIONS

A. Murphy-Leonard, *Understanding Dislocation-Precipitate Interactions in Nickel-Aluminum-Bronze During In-SEM Loading*, Presented at the 13th Annual Fatigue Congress (2023), Hiroshima, Japan

A. Murphy-Leonard, *Keynote Speaker*, Presented at the Annual S-STEM Scholars Meeting (2023), American Association for the Advancement of Science, Washington DC. Invited Talk

A. Murphy-Leonard, *Influence of Precipitate-Dislocation Interactions on Crack Initiation Damage in Additively Manufactured Nickel-Aluminum-Bronze* Presented at the National Academies and African Academy of Science Joint Workshop on U.S.-

Africa Frontiers of Science, Engineering and Medicine Symposium (2022). Invited Talk

A. Murphy-Leonard, *Advanced Microscopy Techniques for Understanding Dislocation Interactions and Damage in Complex Microstructure* Presented at the National Academies Workshop on Materials in Extreme Environments: New Monitoring Tools and Data-Driven Approaches (2022). Invited Talk

A. Murphy-Leonard, *The Truth Inside: Using High Energy X-rays to Understand Deformation in Structural Materials* Presented at the National Junior Science and Humanities Symposium, Albuquerque, New Mexico (2022). Invited Talk

A. Murphy-Leonard, *Investigation of Porosity, Texture, and Damage Evolution of Additively Manufactured 316L Stainless Steel During In-situ Tensile Loading Using High Energy X-rays* Presented at the Graduate Seminar Series in the Department of Materials Science and Engineering at the Colorado School of Mines (2022). Invited Talk

A. Murphy-Leonard, *Investigation of Porosity, Texture, and Damage Evolution of Additively Manufactured 316L Stainless Steel During In-situ Tensile Loading Using High Energy X-rays* Presented at the Graduate Seminar Series in the Department of Chemical and Materials Science and Engineering at the University of Kentucky (2022). Invited Talk

A. Murphy-Leonard, *Investigation of Porosity, Texture, and Damage Evolution of Additively Manufactured 316L Stainless Steel During In-situ Tensile Loading Using High Energy X-rays* Presented at the Graduate Seminar Series in the Department of Materials Science and Engineering at University of Virginia (2021). Invited Talk

A. Murphy-Leonard, *Investigating the Influence of Alloying and Grain Size on Low-Cycle Fatigue Behavior in Magnesium* Presented at the Graduate Seminar Series in the Department of Materials Science and Engineering at the University of Maryland-College Park (2021). Invited Talk

A. Murphy-Leonard, *Investigation of Porosity, Texture, and Damage Evolution of Additively Manufactured 316L Stainless Steel During In-situ Tensile Loading Using High Energy X-rays* Presented at the annual Minerals, Metals, and Materials Society (2021). Invited Talk

A. Murphy-Leonard, *Understanding Twinning-Detwinning Behavior of Unalloyed Mg During Low Cycle Fatigue Using High Energy X-ray Diffraction* Presented at the annual Minerals, Metals, and Materials Society (2021). Invited Talk

A. Murphy-Leonard, *Investigating the Influence of Alloying and Grain Size on Low-Cycle Fatigue Behavior in Magnesium* Presented at the Graduate Seminar Series in the Department of Materials Science and Engineering at Carnegie Mellon University (2020). Invited Talk

A. Murphy-Leonard, *Investigating the Influence of Alloying and Grain Size on Low-Cycle Fatigue Behavior in Magnesium* Presented at the Graduate Seminar Series in the Department of Materials Science and Engineering at the Georgia Institute of Technology (2019). Invited Talk

A. Murphy-Leonard, *Investigating the Influence of Alloying and Grain Size on Low-Cycle Fatigue Behavior in Magnesium* Presented at the Graduate Seminar Series in the Department of Mechanical Engineering at John Hopkins University (2020). Invited Talks

A. Murphy-Leonard, *Quantification of Twinning-Detwinning Behavior During Low-Cycle Fatigue of Pure Magnesium Using High Energy X-Ray Diffraction* Presented at the annual PRISMS (2019)

A. Murphy-Leonard, *The Influence of Porosity and Microstructure on Mechanical Behavior in Additive Manufactured 316L Stainless Steel Using In-Situ X-ray Computed Tomography and Electron Microscopy* Presented at the annual Materials Science and Technology Conference (2020)

A. Murphy-Leonard, *The Influence of Aluminum On Twinning-Detwinning Behavior During Low-Cycle Fatigue of Magnesium Using High Energy X-Ray Diffraction* Presented at the annual Minerals, Metals, and Materials Society Conference (2019)

A. Murphy, *The Effect of Grain Size on Low Cycle Fatigue Behavior in Magnesium* Presented at the annual Minerals, Metals, and Materials Society Conference (2018)

A. Murphy, *The Recrystallization Behavior of Unalloyed Mg and Mg-Al Alloy* Presented at the annual Minerals, Metals, and Materials Society Conference (2018)