

RESEARCH INTERESTS

- Advanced manufacturing, specifically additive manufacturing of metals and alloys
- Model-based simulations of materials using frameworks such as crystal plasticity
- Microstructure characterization through conventional and advanced (e.g., synchrotron) techniques
- Data science and machine learning approaches to elucidate process-structure-property relationships

EDUCATION

Doctor of Philosophy, Mechanical Engineering Georgia Institute of Technology, <i>Atlanta, GA</i>	May 2021
Master of Science, Mechanical Engineering Georgia Institute of Technology, <i>Atlanta, GA</i>	May 2018
Bachelor of Science, Mechanical Engineering Minor in Computational Science Rose-Hulman Institute of Technology, <i>Terre Haute, IN</i>	Nov 2015

RESEARCH EXPERIENCE

School of Aeronautics and Astronautics, Purdue University, *West Lafayette, IN* Jul 2021 – Present

[Dr. Michael D. Sangid Research Group](#)

Postdoctoral Research Associate and Research Engineer

- **Program:** Towards a standard for rapid qualification of additive manufactured materials based on defect structures, funded by the National Institute of Standards and Technology (NIST)
Role: Postdoctoral Research Associate
Project summary: Widespread adoption of additive manufacturing (AM) relies on the ability to rapidly qualify AM materials and reliably assess the impact of pore defects on fatigue resistance. I integrated component-scale fatigue tests, crystal plasticity models, high-energy x-ray diffraction experiments, and machine learning to quantify the reduction in fatigue resistance due to porosity in Ni-based superalloy IN718. This work promotes a hybrid approach combining experimental mechanical tests with microstructure-based simulations, aiming to reduce reliance on traditional mechanical testing for AM material qualification. These efforts have resulted in three first-author journal publications, with several others in preparation.
- **Program:** [Hypersonics Advanced Manufacturing Technology Center \(HAMTC\)](#), funded by the Department of Defense, Manufacturing Technology Program as a Controlled Unclassified Information (CUI) project
Role: Research Engineer
Project summary: Development of new and affordable hypersonics capabilities is critical for national security. As a research engineer at HAMTC, I supported projects on i) the redesign of a scramjet to leverage additive manufacturing capabilities by developing thermal and structural finite element models, ii) advancing critical joining technologies for ceramic components in boost glide vehicles through close mentorship of graduate students, and iii) novel niobium alloy development for additive manufacturing through meetings with collaborators and internal research engineers and graduate students.
- **Program:** Growing Additive Manufacturing Maturity for Airbreathing Hypersonics (GAMMA-H), funded by the Department of Defense, Manufacturing Technology Program as a CUI project
Role: Research Engineer and Team Lead
Project summary: Traditional manufacturing processes are inadequate for producing the complex geometries required in advanced hypersonic vehicles. Additionally, the government's supply chain for these components is constrained, with limited opportunities for small businesses and non-traditional defense contractors to contribute during times of need. This program leverages commercial off-the-shelf (COTS) AM thermal history process modeling software, alongside mechanical testing, to develop a digital twin of hypersonic components. The digital twin will compare variability in part distortion and porosity, as well as the associated reduction in

mechanical properties due to porosity, predicted using different COTS software and experimentally characterized by several small business vendors selected to manufacture demonstrative hypersonic components. As team lead, I manage day-to-day research activities, mentor three undergraduate student researchers that I recruited for the project, and interface with the project sponsor and software representatives.

- As a senior member of the research group, I have mentored four undergraduate, three master's, and seven doctoral students on projects including those listed above as well as:
 - Identifying hydrogen-density based laws for plasticity in polycrystalline materials
 - Influence of porosity and surface treatment on fatigue performance in AM Ti-6Al-4V
 - Efficacy of cold spray aluminum as an AM repair technique
 - Mesoscale thermomechanical modeling of woven carbon composites

School of Mechanical Engineering, Georgia Institute of Technology, Atlanta, GA

Aug 2016 – May 2021

[Dr. David L. McDowell Research Group](#)

Graduate Research Assistant

Thesis: [Integrated Computational Materials Engineering Workflows for Microstructure-Sensitive Fatigue of Advanced Alloys](#)

Project summary: The high cost and data variability of physical fatigue experiments, particularly in the High Cycle Fatigue (HCF) regime, requires a paradigm shift to efficiently assess the fatigue criticality of metallic components. Integrated Computational Materials Engineering (ICME) presents an attractive additional pathway that employs microstructure-sensitive simulations given accessible process paths and resulting microstructures to assist and augment decision-support from experiments. I implemented Python workflows to study the effects of intrinsic and extrinsic microstructure attributes, boundary conditions, strain states, and model sample sizes on fatigue resistance. Digital microstructure models of Duplex Ti-6Al-4V and Al 7075-T6 were simulated using crystal plasticity finite element constitutive models, with extreme value fatigue response as the primary performance requirement. Fatigue Indicator Parameters (FIPs) were used as surrogate measures of the driving force for fatigue crack formation. A major contribution of this work is the open-source [PRISMS-Fatigue](#) framework, which is a highly efficient, scalable, flexible, and easy-to-use community ICME platform.

X-ray Science Division, Argonne National Laboratory, Lemont, IL

May – Sep 2020

[Materials Physics and Engineering \(MPE\) Group](#)

Graduate Researcher

- Analyzed high-energy x-ray diffraction data collected *in situ* during fatigue testing of Ti-6Al-4V
- Reconstructed digital microstructure for crystal plasticity simulations using data fusion approaches

PEER-REVIEWED PUBLICATIONS (Summary: 9 first-author, 7 co-author)

16. K. S. Stopka, A. Desrosiers, A. Andreaco, and M. D. Sangid. A methodology for the rapid qualification of additively manufactured materials based on pore defect structures. *Integr. Mater. Manuf. Innov.*, **13**, 335-359 (2024) [doi](#)
15. R. Bandyopadhyay, K. S. Stopka, and M. D. Sangid. Initializing intragranular residual stresses within statistically equivalent microstructures for crystal plasticity simulations. *J. Mech. Phys. Solids*, **184**, 105529 (2024) [doi](#)
14. K. S. Stopka and M. D. Sangid. Modeling fatigue behavior of additively manufactured alloys with an emphasis on pore defect morphology. *J. Mech. Phys. Solids*, **181**, 105429 (2023) [doi](#)
13. M. Yaghoobi, K. S. Stopka, D. L. McDowell, L. Graham-Brady, and K. Teferra. Effect of sample size on the maximum value distribution of fatigue driving forces in metals and alloys. *Int. J. Fatigue*, **176**, 107853 (2023) [doi](#)
12. K. S. Stopka, A. Desrosiers, T. Nicodemus, N. Krutz, A. Andreaco, and M. D. Sangid. Intentionally seeding pores in additively manufactured alloy 718: process parameters, microstructure, defects, and fatigue. *Addit. Manuf.*, **66**, 103450 (2023) [doi](#)
11. T. Gu, K. S. Stopka, C. Xu, and D. L. McDowell. Modeling the statistical distribution of fatigue crack formation lifetime in large volumes of polycrystalline microstructures. *Acta Mater.*, **246**, 118715 (2023) [doi](#)
10. K. S. Stopka, M. Yaghoobi, J. E. Allison, and D. L. McDowell. Microstructure-sensitive modeling of surface roughness and notch effects on extreme value fatigue response. *Int. J. Fatigue*, **166**, 107295 (2023) [doi](#)
9. K. S. Stopka, M. Yaghoobi, J. E. Allison, and D. L. McDowell. Simulated effects of sample size and grain neighborhood on the modeling of extreme value fatigue response. *Acta Mater.*, **224**, 117524 (2022) [doi](#)
8. A. Lakshmanan, M. Yaghoobi, K. S. Stopka, et al. Crystal plasticity finite element modeling of grain size and morphology effects on yield strength and extreme value fatigue response. *J. Mater. Res. Technol.*, **19**, 3337-3354 (2022) [doi](#)

7. **K. S. Stopka**, M. Yaghoobi, J. E. Allison, and D. L. McDowell. Effects of boundary conditions on microstructure-sensitive fatigue crystal plasticity analysis. *Integr. Mater. Manuf. Innov.*, **10**, 393-412 (2021) [doi](#)
6. M. Yaghoobi, **K. S. Stopka**, A. Lakshmanan, V. Sundararaghavan, et al. PRISMS-Fatigue computational framework for fatigue analysis in polycrystalline metals and alloys. *npj Comput. Mater.*, **7**, 38 (2021) [doi](#)
5. **K. S. Stopka** and D. L. McDowell. Microstructure-sensitive computational multiaxial fatigue of Al 7075-T6 and duplex Ti-6Al-4V. *Int. J. Fatigue*, **133**, 105460 (2020) [doi](#)
4. **K. S. Stopka** and D. L. McDowell. Microstructure-sensitive computational estimates of driving forces for surface versus subsurface fatigue crack formation in duplex Ti-6Al-4V and Al 7075-T6. *JOM*, **72**, 28-38 (2020) [doi](#)
3. **K. S. Stopka**, T. Gu, and D. L. McDowell. Effects of algorithmic simulation parameters on the prediction of extreme value fatigue indicator parameters in duplex Ti-6Al-4V. *Int. J. Fatigue*, **141**, 105865 (2020) [doi](#)
2. T. Gu, **K. S. Stopka**, C. Xu, and D. L. McDowell. Prediction of maximum fatigue indicator parameters for duplex Ti-6Al-4V using extreme value theory. *Acta Mater.*, **188**, 504-516 (2020) [doi](#)
1. A. E. Tallman, **K. S. Stopka**, L. P. Swiler, Y. Wang, et al. Gaussian-process-driven adaptive sampling for reduced-order modeling of texture effects in polycrystalline alpha-Ti. *JOM*, **71**, 2646-2656 (2019) [doi](#)

PUBLICATIONS IN PREPARATION

2. P. E. Morrison, **K. S. Stopka**, J. I. Ferguson, G. S. Welsh, and M. D. Sangid. Evaluating the damage tolerant behavior of cold spray repaired aluminum alloys.
1. J. Solano, S. E. Gustafson, P. J. Noell, **K. S. Stopka**, J-S. Park, P. Kenesei, K. Johnson, and M. D. Sangid. Identifying the precursors to ductile failure via void nucleation and coalescence.

CONFERENCE PROCEEDINGS

2. **K. S. Stopka**, J. Smallwood, A. Chokshi, S. D. Heister, and M. D. Sangid. Structural and fatigue analysis of a rotating detonation rocket engine. *American Institute of Aeronautics and Astronautics (AIAA) SciTech Forum* (2023) [doi](#)
1. **K. S. Stopka**, G. Whelan, and D. L. McDowell. Microstructure-sensitive ICME workflows for fatigue critical applications. *Society of the Advancement of Material and Process Engineering (SAMPE)* (2019) [doi](#)

CONFERENCE PRESENTATIONS AND TALKS

26. **UPCOMING:** **K. S. Stopka**, J. Solano, P. Kenesei, J-S. Park, H. Sharma, and M. D. Sangid. Synchrotron in situ characterization of fatigue crack initiation influenced by intentionally seeded porosity in an additively manufactured superalloy. *The Minerals, Metals & Materials Society (TMS 2025)*, Las Vegas, NV, March 2025.
25. **UPCOMING:** **K. S. Stopka** and M. D. Sangid. Modeling fatigue crack initiation and propagation life in additively manufactured alloys across fatigue regimes. *TMS 2025*, Las Vegas, NV, March 2025.
24. **UPCOMING:** P. E. Morrison, **K. S. Stopka**, J. I. Ferguson, and M. D. Sangid. Fatigue Resistance of Aluminum Alloy Components Repaired Using Cold Spray. *TMS 2025*, Las Vegas, NV, March 2025.
23. **K. S. Stopka**, Y. Sun, P. Kenesei, J-S. Park, J. Solano, A. Desrosiers, et al. Rapid Qualification of Additively Manufactured Materials with Pore Defects. *Future Leaders in Aerospace Symposium*, Stanford, CA, May 17th, 2024.
22. M. D. Sangid, **K. S. Stopka**, and K. Jung (joint presentation). Scientific Examples and Demonstration of Fast Fourier Transform-based Simulations with X-ray Experiments to Explore Deformation and Fatigue in Structural Alloys. *Advanced Photon Source (APS) 2024 User Meeting*, Lemont, IL, May 8th, 2024.
21. **K. S. Stopka**, Y. Sun, P. Kenesei, J-S. Park, J. Solano, A. Desrosiers, et al. Multimodal Characterization and Modeling of Additively Manufactured Alloys with Intentionally Seeded Pores. *TMS 2024*, Orlando, FL, March 7th, 2024.
20. **K. S. Stopka** and M. D. Sangid. Crystal Plasticity Fatigue Modeling of Additively Manufactured Materials with Various Pore Defect Morphology. *TMS 2024*, Orlando, FL, March 5th, 2024.
19. **K. S. Stopka**, A. Desrosiers, T. Nicodemus, N. Krutz, A. Andreaco, and M. D. Sangid. Intentionally seeding pores in laser powder bed fusion IN718: microstructure, defects, and fatigue. *TMS 2023*, San Diego, CA, March 22nd, 2023.
18. **K. S. Stopka** and M. D. Sangid. Modeling fatigue resistance in additively manufactured alloys with porosity defects. *TMS 2023*, San Diego, CA, March 22nd, 2023.
17. **K. S. Stopka**, J. Smallwood, A. Chokshi, S. D. Heister, and M. D. Sangid. Structural and fatigue analysis of a rotating detonation rocket engine. *AIAA SciTech Forum*, National Harbor, MD, January 26th, 2023.
16. **K. S. Stopka** and M. D. Sangid. Experimental validation of crystal plasticity models with additively manufactured defects. *AIAA SciTech Forum*, National Harbor, MD, January 23rd, 2023.
15. **K. S. Stopka**, A. Desrosiers, T. Nicodemus, A. Andreaco, and M. D. Sangid. Examining the micromechanical response of additively manufactured Alloy 718 intentionally seeded with pores. *Workshop on High-Energy Diffraction Microscopy analysis using Microstructural Imaging using Diffraction Analysis Software (MIDAS)*, Lemont, IL, November 9th, 2022.

14. **INVITED: K. S. Stopka** and M. D. Sangid. Micromechanical modeling of porosity defects in additively manufactured alloys. *International Conference on Additive Manufacturing (ICAM 2022)*, Orlando, FL, November 3rd, 2022.
13. **K. S. Stopka**, A. Desrosiers, T. Nicodemus, A. Andreaco, and M. D. Sangid. Progress towards a standard for rapid qualification of additively manufactured materials based on defect structures. *ICAM 2022*, Orlando, FL, November 2nd, 2022.
12. **INVITED: K. S. Stopka**, M. Yaghoobi, J. E. Allison, D. L. McDowell, and M. D. Sangid. Modeling fatigue using digital microstructures: applications of DREAM.3D. *2022 Workshop on Methods for Three-Dimensional Microstructure Studies*, Pittsburgh, PA, August 17th, 2022.
11. **K. S. Stopka**, M. Yaghoobi, A. Lakshmanan, J. E. Allison, and D. L. McDowell. Microstructure-sensitive modeling of surface roughness and notch effects on extreme value fatigue response. *2022 Annual PRISMS Center Workshop*, August 12th, 2022, virtual event.
10. **K. S. Stopka**, M. Yaghoobi, J. E. Allison, and D. L. McDowell. Effects of boundary conditions on microstructure-sensitive fatigue crystal plasticity analysis. *The 6th World Congress on Integrated Computational Materials Engineering (ICME 2022)*, Incline Village, NV, April 25th, 2022.
9. **K. S. Stopka** and M. D. Sangid. Micromechanical modeling of porosity defects in additively manufactured alloys. *TMS 2022*, Anaheim, CA, March 2nd, 2022.
8. **K. S. Stopka**, M. Yaghoobi, J. E. Allison, and D. L. McDowell. Microstructure effects on the extreme value fatigue response of FCC metals and alloys: effects of sample size and grain neighborhood. *TMS 2022*, Anaheim, CA, March 1st, 2022.
7. **K. S. Stopka**, M. Yaghoobi, A. Lakshmanan, V. Sundararaghavan, J. E. Allison, and D. L. McDowell. PRISMS-Fatigue: overview and case studies. *2021 Annual PRISMS Center Workshop*, August 3rd, 2021, virtual event.
6. **K. S. Stopka**, J.S. Park, H. Sharma, et al. Reconstruction of microstructure and defects in an Alpha + Beta processed Ti-6Al-4V plate product using High-energy X-ray Diffraction Microscopy and DREAM.3D. *5th International Congress on 3D Materials Science (3DMS 2021)*, July 1st, 2021, virtual event.
5. **K. S. Stopka** and D. L. McDowell. Effects of surface roughness on microstructure-sensitive computations of fatigue crack formation driving force in duplex Ti-6Al-4V and Al 7075-T6. *TMS 2020*, San Diego, CA, February 26th, 2020.
4. **K. S. Stopka** and D. L. McDowell. Microstructure-sensitive computational estimates of driving forces for surface vs. subsurface fatigue crack formation in Duplex Ti-6Al-4V and Al 7075-T6. *Materials Science and Technology (MS&T) 2019*, Portland, OR, September 30th, 2019.
3. **K. S. Stopka** and D. L. McDowell. Microstructure-sensitive computational multiaxial fatigue. *12th International Conference on Multiaxial Fatigue and Fracture (ICMFF12) 2019*, Bordeaux, France, June 24th, 2019.
2. **K. S. Stopka**, A. E. Tallman, L. P. Swiler, Y. Wang, et al. Gaussian-process-driven adaptive sampling for reduced-order modeling of texture effects in polycrystalline alpha-Ti. *TMS 2019*, San Antonio, TX, March 12th, 2019.
1. **K. S. Stopka** and D. L. McDowell. Computational statistics of formation and early growth of microstructurally small cracks in Ti-6Al-4V. *MS&T 2018*, Columbus, OH, October 17th, 2018.

MENTORSHIP

Georgia Institute of Technology, Atlanta, GA

Aug 2018 – May 2019

Leadership Education and Development (LEAD) Coach

- Met one-on-one with undergraduate and graduate students for personalized coaching sessions
- Coached a total of six students during the 2018-2019 academic year

Purdue University, West Lafayette, IN

July 2021 – Present

Postdoctoral Research Associate

- Mentored an undergraduate students during the 2021 [Summer Undergraduate Research Fellowship \(SURF\) program](#) and three others during the Spring 2023 and Summer 2024 term within Dr. Micheal D. Sangid's research group
- Mentored seven doctoral students and three master's students through weekly meetings

AWARDS

- [Bravo+ employee recognition program](#) – Purdue University (2024)
- [Outstanding Pole Abroad](#) (Chicago & Midwest region), Science Category – Consulate General of the Republic of Poland in Chicago (2024)
- [President's Fellowship](#) – Georgia Institute of Technology (2016 – 2019)
- Graduate Scholarship – Polish National Alliance (2016 – 2019)

SERVICE

The Minerals, Metals & Materials Society (TMS)

Mar 2021 – Present

- [Committee member](#): Integrated Computational Materials Engineering (ICME), Mechanical Behavior of Materials
- Co-organizer of [Fatigue in Materials: Fundamentals, Multiscale Characterizations and Computational Modeling](#) symposium

Peer reviewer (69 total manuscript reviews) for the following journals, [Publons Profile](#)

Mar 2019 – Present

- Acta Materialia
- Additive Manufacturing
- Applied Science
- Engineering Failure Analysis
- Engineering Fracture Mechanics
- Frontiers in Materials
- International Journal of Fatigue
- International Journal of Fracture
- International Journal of Plasticity
- JOM
- Materialia
- Mathematics

Grant proposal reviewer for the following organizations:

Aug 2023 – Present

- Deutsche Forschungsgemeinschaft (German Research Foundation); ~\$400,000 budget requested

[Polish American Engineers Association \(PAEA\)](#)

Oct 2023 – Present

- Active member involved in monthly presentations and new member recruitment

PROFESSIONAL DEVELOPMENT

Georgia Institute of Technology, Atlanta, GA

Fall 2019 – Fall 2020

[Tech to Teaching](#), Center for Teaching and Learning

- Completed two graduate-level courses and a capstone teaching experience to prepare future faculty
- Delivered six lectures in graduate-level courses on *Fatigue of Materials and Structures* and *Fundamentals of Fracture Mechanics*

LANGUAGES:

- English – Native proficiency
- Polish – Fluent proficiency
- Spanish – Elementary proficiency

INDUSTRY EXPERIENCE

B/E Aerospace, Rockford, IL

Dec 2015 – Jul 2016

Project Engineer

- Conducted Root Cause Analysis to improve reliability of Vacuum Pump
- Worked with customers / suppliers to improve Vacuum Pump performance for multiple aircraft
- Collaborated with design engineers to redesign Embraer Vacuum Waste System

GE Aviation, Evendale, OH

Jun – Aug 2015

GEnx Engine Performance Intern

- Remedied process of deriving humidity and condensation fan speed adders for production
- Calculated Test Vectors to support new 76K thrust rating for Boeing
- Determined effects of engine's physical turbine deviation on thrust and SFC

Space Exploration Technologies (SpaceX), Hawthorne, CA

Sep – Nov 2014

Structures Intern

- Designed testing fixture for v2.0 Landing Leg weather seal Research and Development
- Directed tensile, fatigue, torch, and vacuum testing to validate Pyron and Nomex felts as replacement for cork as Temperature Protection System on Falcon 9 Landing Legs
- Evaluated strength of Carbon Fiber samples with Composi-lok fasteners for v2.0 Landing Legs

GE Aviation, Rockford, IL

Jun – Aug 2014

Manufacturing Engineering Intern

- Appraised LEAP combustor Nacelle Anti-Ice Valve drawings for manufacturability and cost
- Enhanced Qualification Matrix to expand site worker versatility
- Created drawings and process plans for developmental parts using SolidWorks

Tesla Motors, Fremont, CA

Sep 2013 – Feb 2014

Craftsmanship Vehicle Engineering Intern

- Determined root cause and solution to Model S Instrument Panel fitment inconsistency
- Enriched Research and Development for Model X program to study what competitor vehicles are doing and set competitive or class leading margins for interior and exterior components
- Sourced an E-Cube and Blue Buck project to aid Model X future dimensional quality
- Lead and assisted in custom Model S builds to assess new and modified components

GE Aviation, Terre Haute, IN

Mar – Aug 2013

Manufacturing Engineering Intern

- Completed weld certifications and gathered dimensional data for Passport and LEAP combustors
- Interpreted GD&T blueprints for online characteristic accountability system
- Updated operation sketches, part routers and check sheets

Diesel Radiator Company, Melrose Park, IL

Jun – Aug 2012

Design and Manufacturing Engineering Intern

- Reduced steel scrap by an average of 9.7% for high quantity radiator jobs
- Designed facility apparatuses, such as stainless-steel ductwork, and a brass uncoiler and shear rail
- Resolved day to day computer numerical control issues affecting production