MUJAN N. SEIF

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RESEARCH INTERESTS

I am motivated to solve thermomechanical problems related to space exploration and sustainability originating from an incomplete knowledge of material structure. My research interest lies in the mesoscale behaviour of metamaterials engineered to perform in extreme environments.

EDUCATION

University of Kentucky **Lexington, KY**
Ph.D. in Materials Science & Engineering **September 2022**

Dissertation: "Application of multi-scale computational techniques to complex materials systems"
Thesis Committee: Matthew J. Beck (MSE, Advisor), T. John Balk (MSE), Alexandre Martin (MAE), Eric Stern (NASA Ames Research Center), Martin Kordesch (Physics, Ohio University), W. Brent Seales (CS)

University of Kentucky **Lexington, KY**
B.S. in Materials Science & Engineering **May 2017**
Minors in Economics and Mathematics

PROFESSIONAL APPOINTMENTS

Postdoctoral Research Assistant **Present**
University of Oxford, Solid Mechanics and Materials Engineering Group

Mesoscale modeling ◇ discrete dislocation dynamics ◇ constitutive laws ◇ grain boundary engineering ◇ dislocation mobility laws ◇ plastic flow ◇ plastic constitutive relations

Research Member of the Common Room **Present**
Kellogg College, University of Oxford

Postgraduate advising

Space Technology Graduate Research Fellow **April 2020 – Dec. 2022**
NASA (Space Technology Mission Directorate)

Mesoscale modeling ◇ micrometeroid and orbital debris shielding ◇ porous structures ◇ metamaterials ◇ finite element ◇ stochastic modeling ◇ statistical approach ◇ aluminum foam ◇ Duocel ◇ linear elasticity ◇ thermal protection systems ◇ uncertainty quantification ◇ cavity defects ◇ carbon fiber materials ◇ FiberForm ◇ size effects

Graduate Research Assistant **Aug. 2018 – Dec. 2022**
University of Kentucky, Dept. of Chemical & Materials Engineering

Ab initio approaches ◇ scandate cathodes ◇ thermionic emission ◇ surface science ◇ surface stability ◇ density functional theory ◇ density functional perturbation theory ◇ transition state theory ◇ Wulff shape prediction ◇ surface composition ◇ stochastic modeling ◇ thermal protection systems ◇ uncertainty quantification ◇ size effects

Visiting Technologist **July 2022 – Nov. 2022**
NASA Ames Research Center & Johnson Space Center

Thermal protection systems ◇ metamaterials ◇ additively-manufactured thermal protection systems ◇ ceramic composites ◇ carbon composites ◇ discrete dislocation dynamics ◇ materials in hypersonic environments ◇ uncertainty quantification

Post-Baccalaureate Researcher **Aug. 2017 – April 2018**
University of Michigan, Dept. of Materials Science & Engineering

Microstructural evolution ◇ LSCF electrodes ◇ phase-field calculations ◇ spinodal decomposition ◇ Cahn-Hilliard equations

PROFESSIONAL DISTINCTIONS AND ACTIVITIES

Awards

Outstanding MSE Ph.D. Student	CME Dept., University of Kentucky, 2022
Outstanding MSE Ph.D. Student	CME Dept., University of Kentucky, 2021
Finalist, 3MT Competition	The Graduate School, University of Kentucky, 2020
Winner, 3MT Competition	CME Dept. Graduate Student Association, 2020
Finalist, Best Student Paper	International Vacuum Electronics Conference, 2020
Space Technology Graduate Research Fellowship	NASA, 2020
Outstanding Collegiate Member Award	Society of Women Engineers, 2019
Honorable Mention, NSF GRFP	National Science Foundation, 2019
Senior Scholarship Award	ASM Bluegrass, 2017
Outstanding MSE Senior	CME Dept., University of Kentucky, 2017
Outstanding MSE Junior	CME Dept., University of Kentucky, 2016

Professional Service

Oxford Research Staff Society

Events Manager — Present

Graduate Society of Women Engineers (University of Kentucky)

Founder, Director — Aug. 2019 – Nov. 2022

Society of Women Engineers

Research Competition Committee Member	Jan. – Dec. 2021
Research Competition Judge	Oct. 2021
WE21 Abstract Submission Reviewer	April 2021
Graduate Programming Coordinator	Oct. 2018 – Feb. 2020
Graduate Programming Coordinator-Elect	Dec. 2017 – Oct. 2018

ASM Bluegrass

Vice Chair — Apr. 2019 – Dec. 2022

Manuscript Review

IEEE Transactions on Electron Devices (IEEE Electron Devices Society)

Professional Memberships

The Minerals, Metals & Materials Society (TMS), American Institute of Aeronautics and Astronautics (AIAA), Society of Women Engineers (SWE)

TEACHING

MSE 301: Materials Science II Jan.-April 2022

University of Kentucky, Dept. of Chemical & Materials Engineering

As an official instructor of record, I designed coursework, wrote exams, gave lectures, held office hours, and completed accreditation documents. As shown in the table below, my students scored my teaching above the mean of both my department and college (out of a maximum 5.0).

Course (MSE 301)		Department		College	
Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
4.6	0.5	4.3	0.9	4.3	0.9

MSE 202: Materials Science Laboratory Aug.-Dec. 2018

University of Kentucky, Dept. of Chemical & Materials Engineering

I served as a teaching assistant for this highly hands-on course for sophomores in materials engineering. I introduced students to casting, polymerization, mechanical testing, and metallography.

Miscellaneous Lectures

University of Kentucky, Dept. of Chemical & Materials Engineering

During my graduate studies, I have served as a substitute lecturer for course instructors who could not attend their classes due to travel, illness, etc. I have given lectures in the following courses:

MSE 402: Electronic Materials and Devices
MSE 401: Metals and Alloys
MSE 351: Materials Thermodynamics
MSE 201: Materials Science I
MSE 101: Introduction to Materials Science (taught as an undergraduate)

PUBLICATIONS

Under Review

1. D. Yang, **M. N. Seif**, G. He, K. Song, A. Morez, B. de Jager, R. J. Harder, W. Cha, E. Tarleton, I. K. Robinson, F. Hofmann. Imaging hydrogen-driven dislocation and strain field evolution in a stainless steel grain. Under Review: *Advanced Materials*. (2025)

Refereed Journals

9. **M. N. Seif**, J. Puppo, M. Zlatinov, D. Schaffarzick, A. Martin, M. J. Beck. Stochastic mesoscale mechanical modeling of metallic foams. *Mathematics and Mechanics of Solids*, 2025; 30(3): 792-805
DOI: 10.1177/10812865241265049

8. S. Miller-Murthy, **M. N. Seif**, M. J. Beck. Scandium wetting of tungsten surfaces in "scandate" thermionic cathodes. *Surfaces and Interfaces*, (2022):102476
DOI: 10.1016/j.surfin.2022.102476

7. **M. N. Seif**, T. J. Balk, M. J. Beck. Deducing surface chemistry and annealing conditions from observed nanoparticle shapes: a study of scandate cathodes. *Applied Surface Science*, (2022): 154541.
DOI: 10.1016/j.apsusc.2022.154541

6. **M. N. Seif**, Q. Zhou, X. Liu, T. J. Balk, M. J. Beck. "Sc-containing (Scandate) Thermionic Cathodes: Mechanisms for Sc Enhancement of Emission," *IEEE Transactions on Electron Devices*, 69(7), 2022.
DOI: 10.1109/TED.2022.3172054

5. **M. N. Seif**, Q. Zhou, X. Liu, T. J. Balk, M. J. Beck. "Sc-containing (Scandate) Thermionic Cathodes: Fabrication, Microstructure, and Emission Performance," *IEEE Transactions on Electron Devices*, 69(7), 2022.
DOI: 10.1109/TED.2022.3172052

4. **M. N. Seif**, D. J. Richardson, K. M. Moody, M. Martin, M. Turner, S. W. Mays, T. J. Balk, M. J. Beck. Stochastic approach for determining properties of randomly structured materials: Effects of network connectivity. *Acta Materialia* (2021): 117382.
DOI: 10.1016/j.actamat.2021.117382

3. **M. N. Seif**, M. J. Beck. Surface energies and equilibrium Wulff shapes in variable chemical environments at finite temperatures. *Applied Surface Science*, 540(2), 2021.
DOI: 10.1016/j.apsusc.2020.148383

2. **M. N. Seif**, T. J. Balk, M. J. Beck. Desorption from Hot Scandate Cathodes: Effects on Vacuum Device Interior Surfaces after Long-Term Operation. *Materials*, 13(22), 2020.
DOI: 10.3390/ma13225149

1. **M. N. Seif**, M. J. Beck. Shape Memory Polymers: A Joint Chemical and Materials Engineering Hands-On Experience. *Chemical Engineering Education*, 52(1), 60-67, 2018.

Full Length Conference Proceedings

9. **M. N. Seif**, J. Puppo, M. Zlatinov, D. Schaffarzick, A. Martin, M. J. Beck. "Stochastic mechanical modeling of MMOD impact-inspired cylindrical cavities in Duocel foam." In AIAA AVIATION 2022 Forum, 2022.
DOI: 10.2514/6.2022-3506

8. **M. N. Seif**, A. Martin, M. J. Beck. "Stochastic mechanical modeling of fibrous ablators: the influence of defects on directional behavior." 2nd International Conference on Flight Vehicles, Aerothermodynamics and Re-entry Missions Engineering (FAR), Heilbronn, Germany. ESA, 2022.

7. **M. N. Seif**, T. J. Balk, M. J. Beck. "Relative Thermodynamic Stabilities of Sc-containing Surface Configurations in Scandate Cathodes." 2022 IEEE 21st International Conference on Vacuum Electronics (IVEC), Monterey, CA, USA. IEEE, 2022.

6. **M. N. Seif**, J. Puppo, M. Zlatinov, D. Schaffarzick, A. Martin, M. J. Beck. "Stochastic mechanical modeling of Duocel foam from micro-to macro-length scales." In AIAA SCITECH 2022 Forum, 2022.
DOI: 10.2514/6.2022-0627

5. M. Ho, **M. N. Seif**, M. J. Beck, S. Leclaire, J. Trépanier, M. Reggio, A. Martin. "Fluid Behavior of Stochastic Porous Structures." 59^{th} AIAA Aerospace Sciences Meeting, 2021.
DOI: 10.2514/6.2021-1443

4. S. M. McDaniel, **M. N. Seif**, M. J. Beck, A. Martin. "Development of Stochastic Model for Fibrous Ablator." AIAA Scitech 2021 Forum, 2021.
DOI: 10.2514/6.2021-1473

3. **M. N. Seif**, S. M. McDaniel, M. J. Beck, A. Martin. "Stochastic Modeling of Elastic Behavior of Fibrous Ablators." AIAA Scitech 2021 Forum. 2021.
DOI: 10.2514/6.2021-1585

2. **M. N. Seif**, T. J. Balk, M. J. Beck. "Temperature Effects on Desorption Behavior and Characteristic Wulff Shapes of Scandate Cathodes." 2020 IEEE 21st International Conference on Vacuum Electronics (IVEC). IEEE, 2020.
DOI: 10.1109/IVEC45766.2020.9520596

1. **M. N. Seif**, B. Vancil, T. J. Balk, M. J. Beck. "Distribution of Desorption Products on Interior Surfaces of Scandate Cathode Test Vehicle." 2020 IEEE 21st International Conference on Vacuum Electronics (IVEC). IEEE, 2020.
DOI: 10.1109/IVEC45766.2020.9520573

Book Chapters

1. **M. N. Seif**. "My Life as a Brown Person." Arab Detroit 9/11: Life in the Terror Decade. Ed. N. Abraham, S. Howell, A. Shryock. Wayne State University Press, 2011. 213-220. Print.

GRANTS AND FELLOWSHIPS

3. **STTR Topic AFX23D-TCS01 (Phase 1)**
Title: Metal Foam Shielding for Hypervelocity Impact (HVI)
Agency: Department of the Air Force
Prime: ERG Aerospace
Role: Senior Participant
Period: June - August 2023
Amount: $75,000 **funded**

2. **Space Technology Graduate Research Fellowship**
Title: Modeling multi-scale material response of foam core sandwich panels for MMOD protection against hypervelocity impacts
Agency: NASA Space Technology Graduate Research Opportunities (19-NSTGRO20-0207)
Based on proposal by: Mujan N. Seif
Period: July 2020 - December 2022
Amount: $80,000/year **funded**

1. **Honorable Mention, NSF Graduate Research Fellowship Program**
Title: High-temperature dynamic surface chemistry of scandate cathodes
Agency: XSEDE via NSF GRFP Honorable Mention (TG-MAT210028)
Based on proposal by: Mujan N. Seif
Period: April 2019 - December 2022
Amount: 1600 SUs **funded**

SYNERGISTIC ACTIVITIES

Special Topic: Academic Leadership Workshop November 2023
UK Reproducability Network
I participated in a selective workshop that united academics across Oxford's campus to train in academic leadership.

Grand Tour Speaker Sept. 2021 – Aug. 2022
University of Kentucky College of Engineering
I was the opening presenter for the UK College of Engineering's "Grand Tour," the College's principle on-campus recruiting activity.

Young Alumni Philanthropy Council Feb. 2021 – Aug. 2022
University of Kentucky College of Engineering
As a member of this inaugural group, I worked to endow an undergraduate scholarship and direct funding to various College research and extracurricular initiatives.

Special Topic: NextProf Nexus September 2020
University of Michigan, Georgia Tech, University of California
I attended this highly-competitive program for graduate students and post-doctoral scholars preparing to pursue an academic career.

Special Topic: ASM Leadership Training August 2019
ASM International
I visited ASM Headquarters to connect with fellow ASM Chapter Leadership and discuss the current state and future of ASM.

PRESENTATIONS

28. "Simulating plastic flow in highly constrained bicrystals with a nodal dislocation dynamics framework." **M. N. Seif**, Daniel Hortelano Roig, Fengxian Liu, Edmund Tarleton, 11th International Conference on Multiscale Materials Modeling, Prague, CZ, September 2024

27. "Simulating plastic flow near grain boundaries with dislocation dynamics." **M. N. Seif**, Fengxian Liu, Edmund Tarleton, TMS Annual Meeting, Orlando, FL, March 2024

26. "Stochastic mechanical modeling of complex, porous microstructures: feature-dominated to mesoscale length scales." **M. N. Seif**, NASA Ames Research Center Seminar, Mountain View, CA, August 2022

25. "Stochastic mechanical modeling of MMOD impact-inspired cylindrical cavities in Duocel foam." **M. N. Seif**, J. Puppo, M. Zlatinov, D. Schaffarzick, A. Martin, M. J. Beck, 2022 AIAA Aviation Forum, Chicago, IL, June 2022

24. "Stochastic mechanical modeling of fibrous ablators: the influence of defects on directional behavior." **M. N. Seif**, A. Martin, M. J. Beck, FAR 2022, Heilbronn, Germany, June 2022

23. "Relative thermodynamic stabilities of Sc-containing surface configurations in scandate cathodes." **M. N. Seif**, T. J. Balk, and M. J. Beck, IEEE International Vacuum Electronics Conference, Monterey, CA, April 2022

22. "Combined effects of heterogeneity and length-scale on mechanical properties of lattice metamaterials." **M. N. Seif** and M. J. Beck, TMS Annual Meeting, Anaheim, CA, February 2022

21. "Stochastic mechanical modeling of Duocel foam from micro- to macro- length scales." **M. N. Seif**, J. Puppo, M. Zlatinov, D. Schaffarzick, A. Martin, M. J. Beck, 2022 AIAA SciTech Forum, San Diego, CA, January 2022

20. "Stochastic mechanical modeling of Duocel foam from micro- to macro- length scales." **M. N. Seif**, A. Martin, E. Stern, M. J. Beck, DCASS (virtual), March 2021

19. "Stochastic modeling of elastic behavior of fibrous ablators." **M. N. Seif**, S. McDaniel, M. J. Beck, A. Martin, SciTech21 (virtual), January 2021

18. "Temperature effects on desorption behavior and characteristic Wulff shapes of scandate cathodes." **M. N. Seif**, T. J. Balk, M. J. Beck, IVEC, Monterey, CA (virtual), October 2020

17. "Temperature effects on desorption behavior and characteristic Wulff shapes of scandate cathodes." **M. N. Seif**, T. J. Balk, M. J. Beck, WE Local, Raleigh, NC, February 2020

16. "Getting the most out of your first research experience" **M. N. Seif**, WE Local, Raleigh, NC, February 2020

15. "Ba transport in thermionic cathodes at operating temperature." **M. N. Seif**, Society of Women Engineers Annual Meeting, Anaheim, CA, November 2019

14. "The Hot Cathode Revolution." **M. N. Seif**, University of Kentucky Graduate School: Pre-3 Minute Thesis Competition, Lexington, KY, October 2019

13. "Stochastic mechanical modeling of nanoporous materials accounting for connectivity and mixed loading states." **M. N. Seif**, S. W. Mays, K. M. Moody, T. J. Balk, A. Martin, M. J. Beck. Materials Science & Technology, Portland, OR, October 2019

12. "Ba transport in scandate cathodes: evaporation, adsorption surface transport at operating temperature." **M. N. Seif**, T. J. Balk, M. J. Beck. Materials Science & Technology, Portland, OR, October 2019

11. "Stochastic modeling of the effect of structural randomness on the mechanical behavior of 3D printed metallic powders." S. W. Mays, K. M. Moody, **M. N. Seif**, A. Martin, M. J. Beck. Materials Science & Technology, Portland, OR, October 2019

10. "The effect of fibrous geometry on thermomechanical behavior of phenolic impregnated carbon ablators for use in thermal protection systems." K. M. Moody, S. W. Mays, **M. N. Seif**, A. Martin, M. J. Beck. Materials Science & Technology, Portland, OR, October 2019

9. "Using KICSS for Stochastic Multiscale Modeling of Random Structures." **M. N. Seif**, S. W. Mays, K. M. Moody, T. J. Balk, A. Martin, M. J. Beck. Integrated Computational Materials Engineering, Indianapolis, IN, July 2019

8. "Determining conditions and mechanisms for barium desorption from scandate cathode surfaces." Q. Zhou, **M. N. Seif**, X. Liu, T. J. Balk, M. J. Beck. TMS, San Antonio, March 2019

7. "Modified Gibson-Ashby model accounting for network coordination derived from stochastic modeling of the mechanical behavior of nanoporous materials." **M. N. Seif**, M. Martin, S. W. Mays, T. J. Balk, M. J. Beck. TMS, San Antonio, March 2019

6. "Getting the most out of your first research experience." **M. N. Seif**. WE Local, St. Louis, MO, March 2019

5. "Update on Current Research." **M. N. Seif**. ASM Bluegrass Chapter, Lexington, KY December 2018

4. "Stochastic modeling of the effects of structural randomness on the mechanical behavior of discontinuous fiber-reinforced composites: revealing the role of network coordination state" **M. N. Seif**, M. Martin, D. J. Richardson, S. Mays, T. J. Balk, M. J. Beck. Materials Science & Technology, Columbus, OH, October 2018

3. "Microstructural Evolution of LSCF Cathode During Coarsening via Surface Diffusion" C.-L. Park, H. Wang, **M. N. Seif**, S. A. Barnett, K. Thornton. Materials Research Society Spring Meeting, Phoenix, AZ, April 2018

2. "Stochastic modeling of the effects of structural randomness on the mechanical behavior of nanoporous materials: revealing the role of network coordination state" **M. N. Seif**, M. Martin, D. J. Richardson, M. Turner, T. J. Balk, M. J. Beck. Graduate Collegiate Competition, WE Local, Tulsa, OK, January 2018

1. "Insights into the Deformation of Nanoporous Gold using Scanning Nanobeam Diffraction" T. J. Balk, **M. N. Seif**, N. J. Briot, J. Ciston, T. C. Pekin, A. M. Minor. Materials Science & Technology, Pittsburgh, PA, October 2017.

OUTREACH AND SERVICE IN THE COMMUNITY

Oxford Earth Day, *Presenter*	April 2024
Stonewall Elementary Science Fair, *Judge*	Dec. 2021
Engineering Open House, *MSE Representative*	Oct. 2021
One Day for UK, *BBNfluencer*	April 2021
Stonewall Elementary Science Fair, *Judge*	Dec. 2020
Alumni Mentors and Motivation, *Engineering Alumni Speaker*	Nov. 2020
Materials Engineering Recruiting Evening, *Alumni Participant*	Oct. 2020
College of Engineering Women in Engineering Evening, *Alumni Speaker*	Sept. 2020
SWE Research Competition Webinar, *Invited Panelist*	May 2020

Tates Creek High School Women in Engineering Panel, *Invited Panelist*	Feb. 2020
SWE's Lunch with an Engineer, *Participant*	Feb. 2020
College of Engineering Grand Tour, *MSE Representative*	Jan.-Feb. 2020
Stonewall Elementary Science Fair, *Judge*	Dec. 2019
Engineering Open House, *GradSWE Representative*	Nov. 2019
Big10 Graduate School Expo, *UK College of Engineering Representative*	Oct. 2019
College of Engineering Grand Tour, *MSE Representative*	Aug. 2020
Women in Engineering Summer Camp, *MSE Representative*	June 2019
REU at the University of Kentucky, *Graduate Student Representative*	June 2019
Stonewall Elementary Science Night, *MSE Representative*	April 2019
Stonewall Elementary Science Fair, *Judge*	Dec. 2018