# MUJAN N. SEIF

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## OBJECTIVE AND PERSONAL SUMMARY

I am a research scientist and engineer seeking to utilise my extensive experience in computational and mathematical modelling, data analytics, coding, quantitative analysis, and technical communication. I hold a Ph.D. in Computational Materials Science & Engineering and am currently a postdoctoral researcher at the University of Oxford.

## 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*

Technical Skills: Mesoscale modelling ◇ discrete dislocation dynamics ◇ plastic constitutive laws ◇ quantitative analysis ◇ MATLAB, Python, R, C, Fortran coding ◇ statistical modelling

Administrative Skills: Code management ◇ student mentorship ◇ technical communication ◇ manuscript preparation ◇ literature review ◇ industrial, government, and academic collaboration ◇ public outreach

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

Technical Skills: Multiphysics frameworks ◇ thermal protection systems ◇ machine learning frameworks ◇ mesoscale modelling ◇ micrometeroid and orbital debris shielding ◇ micromechanics ◇ finite element analysis ◇ computational fluid dynamics ◇ stochastic modelling ◇ statistical methods ◇ uncertainty quantification ◇ OpenFOAM ◇ FEniCS Project ◇ ANSYS ◇ Abaqus ◇ MATLAB, Python, R, C, Fortran coding ◇ HPC systems

Administrative Skills: Grant management ◇ budget preparation ◇ conference organization ◇ code management ◇ manuscript preparation ◇ literature review ◇ proposal writing and submission ◇ student mentorship ◇ technical communication ◇ industrial, government, and academic collaboration ◇ public outreach

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

Technical Skills: *Ab initio* approaches ◇ machine learning frameworks ◇ scandate cathodes ◇ thermionic emission ◇ surface science ◇ stochastic modelling ◇ MATLAB, Python, R, C, Fortran coding

Administrative Skills: Grant management ◇ budget preparation ◇ proposal preparation and submission ◇ student mentorship ◇ technical communication ◇ manuscript preparation◇ literature review ◇ industrial, government, and academic collaboration ◇ public outreach

**Visiting Technologist** **July 2022 – Nov. 2022**

*NASA Ames Research Center & Johnson Space Center*

Technical Skills: Thermal protection systems ◇ additive manufacturing ◇ ceramic composites ◇ carbon composites ◇ discrete dislocation dynamics ◇ hypersonics ◇ ablation ◇ PICA ◇ Fiberform ◇ uncertainty quantification

Administrative Skills: Grant management ◇ budget management ◇ conference organization◇ manuscript preparation ◇ code documentation ◇ technical communication ◇ industrial, government, and academic collaboration

**Post-Baccalaureate Researcher** **Aug. 2017 – April 2018**

*University of Michigan, Dept. of Materials Science & Engineering*

Technical Skills: Microstructural evolution ◇ LSCF electrodes ◇ phase-field calculations ◇ spinodal decomposition ◇ Cahn-Hilliard equations ◇ HPC systems

Administrative Skills: Code management ◇ literature review manuscript preparation ◇ student mentorship ◇ technical communication ◇ academic collaboration

**Associate Investigator Assistant** **Jan. 2014 – Dec. 2014**

*DuPont Titanium Technologies*

Technical Skills: Pilot process design ◇ wet lab research ◇ chemical waste extraction ◇ ASPEN ◇ process modelling

Administrative Skills: Quantitative analysis ◇ supervision of technicians ◇ group management ◇ standard job protocols ◇ technical communication

## PROFESSIONAL DISTINCTIONS AND ACTIVITIES

### Awards

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| **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**

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| 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**

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| 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

2. **M. N. Seif**, J. Cramer, X. Liu, M. J. Beck, T. J. Balk. The relative positions of Ba and Sc on W grains comprising the emitting surface of scandate cathodes. Under review: *IEEE Transactions on Electron Devices*, (2025).

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. Submitted: *Advanced Materials*. (2025)

## Refereed Journals

9. **M. N. Seif**, J. Puppo, M. Zlatinov, D. Schaffarzick, A. Martin, M. J. Beck. Stochastic mesoscale mechanical modelling of metallic foams. *Mathematics and Mechanics of Solids*, 0(0), 2024.
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 modelling 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 modelling 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 modelling 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 modelling 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: modelling 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 modelling, 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 modelling of complex, porous microstructures: feature-dominated to meso-scale length scales." **M. N. Seif**, NASA Ames Research Center Seminar, Mountain View, CA, August 2022

25. "Stochastic mechanical modelling 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 modelling 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 modelling 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 modelling 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 modelling 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 modelling 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 modelling 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 modelling 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 modelling 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 modelling 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 modelling 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

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| **Spotlight on Engineering**, *Presenter* | April 2025 |
| **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 |