

Cole Franz

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(865) 235-7245

Ph.D. Candidate in Materials Science and Engineering with 6 years of relevant experience including: advanced characterization, x-ray and neutron diffraction, solid-state welding, failure analysis, and student leadership.

RESEARCH EXPERIENCE

PhD Candidate:

The University of Tennessee

Knoxville, TN

Sept. 2022 – Present

- Used energy-dispersive X-ray diffraction to quantify accumulated plastic strains at fine length-scale and understand its influence on residual strain development in solid-state additive manufacturing.
- Applied neutron diffraction with full-tensor methods to analyze fundamentals of residual stress in the same process.
- Proposed and led beamline experiments in collaboration with scientists at Oak Ridge National Lab, Brookhaven National Lab, and Los Alamos National Lab:
 - Successful proposal and re-invitation for additional beamtime at the newly constructed HEX end station at the National Synchrotron Light Source II to refine microstructure quantification with a novel detector setup.
 - Two accepted proposals at the High Flux Isotope Reactor to investigate complex residual strain states and develop methods for quantifying hidden bias and true uncertainty.

EDUCATION

Dissertation: Understanding Plastic-Strain Accumulation and Residual Stresses in Additive Friction-Stir Deposition.

Research Advisors: Prof. Sudarsanam Suresh Babu and Prof. Katharine Page.

- Ph.D. in Materials Science and Engineering at The University of Tennessee, Knoxville – *registered* Dec. 2025
- M.S. in Materials Science and Engineering at The University of Tennessee, Knoxville – May 2022
- B.S. in Materials Science and Engineering at The University of Tennessee, Knoxville – May 2021

* Cumulative GPA: 3.64 / 4.00

PUBLICATIONS

Peer Reviewed Articles:

- Metz, P.C.; Franz, C.; Kincaid, J.; et al., “Heterogeneous microstructure development in additive friction-stir deposited Al–Mg–Si alloy.” *Additive Manufacturing*, 2024.
- Metz, P.C.; Arwood, Z.; Franz, C.; “Non-uniform plastic deformation in additive friction stir deposited Ti-6Al-4V.” *Materialia*, 2023.

In Preparation:

- Franz, C.; Wing, B.; Fancher, C.; Page, K.; Babu, S.; “Part-Scale Evolution of Microstructural Heterogeneity Quantified at Fine Length-Scale in Solid-State Additive Manufacturing Process.” *Manuscript finished*, to be submitted to *npj Advanced Manufacturing*, July 2025.
- Franz, C.; Patterson, R.; Watkins, T.; Page, K.; Babu, S.; “Influence of Large and Fine Length-Scale Misfits on Residual Stress in Additive Friction-Stir Deposition of AA6061.”, *Manuscript in preparation*, to be submitted to *Additive Manufacturing*, 2025.

- Franz, C.; Prime, M.; Bunn, J.; Payzant, A.; Page K.; “Uncovering Bias and Underestimated Errors in Neutron Diffraction Residual Strain Measurements.” *In preparation*, to be submitted to *Journal of Applied Crystallography*, 2025.

TECHNICAL SKILLS

Residual Stress and Microstructure: Competent in diffraction-based techniques for residual stress analysis and microstructural quantification, including x-ray (laboratory and synchrotron) and neutron methods.

Microscopy and Advanced Characterization: Experienced in metallography, optical and scanning electron microscopy, and advanced characterization methods including electron backscatter diffraction, texture analysis, and thermography.

Failure Analysis: Analyzed a wide breadth of materials compositions and types of fusion and solid-state welds.

Communication: Scientific presentation to collaborators in the U.S. ARMY, to experts in the field of residual stress (ASM RSTC), and to general audiences at conferences (IACMI, JEC, IMAT, TMS, etc.).

PROFESSIONAL EXPERIENCE

Metallographer and Failure Analyst:

Fulton Bellows

Knoxville, TN

Sept. 2020 – Aug. 2022

- Improved efficiency by recommending process adjustments to reduce costs.
- Managed relationships by presenting key data to align technical understanding across different parties.
- For more information, see “Forging Partnerships”, *Tickle College of Engineering*, Sept. 2021.

AWARDS

Best in Destruction and 2nd Place:

ASM DomesDay Competition – IMAT 2022

- Designed, investment-casted, heat-treated, anodized, and destroyed an A356 geodesic dome from scratch.

Best Student Presentation Award:

ORNL Joint Nanoscience and Neutron Scattering User Meeting 2025

- “Uncovering Bias and Underestimated Errors in Neutron Diffraction Residual Strain Measurements”

Robert L. Snyder Student Award

Denver X-ray Conference 2025

- “Part-Scale Evolution of Microstructural Heterogeneity Quantified at Fine Length-Scale in Solid-State Additive Manufacturing Process”

1st Place Graduate Student Poster:

Oak Ridge Chapter of ASM – Student Poster Night 2023

- “Characterization of Failure Mechanisms in Aluminum Alloy Manufactured by Solid-State AM”

Outstanding Academic Student Organization:

Student Engagement Awards, April 2024

- President / VP of the UTK Chapter of Materials Research Society for 3 years.

PRESENTATIONS AND CONFERENCES

- *Pending invited talk* at the International Conference on Residual Stress – “Uncovering Bias and Underestimated Errors in Neutron Diffraction Residual Strain Measurements” – October 20th, 2025.

- *Poster* at Denver X-Ray Conference – “Part-Scale Evolution of Microstructural Heterogeneity Quantified at Fine Length-Scale in Solid-State Additive Manufacturing Process” – August 4th, 2025.
- *Invited talk* at the National Synchrotron Light Source II – “Part-scale Quantification of Microstructure at Fine Length-Scale at the Novel NSLS-II HEX beamline” – June 20th, 2025.
- *Invited talk* to experts in my field at the ASM Residual Stress Technical Committee – “Full Tensor Examination of Large and Fine Length-Scale Residual Stresses in Solid-State Additive Manufacturing” – Nov. 20th 2024.
- Five semi-annual presentations to U.S. ARMY collaborators on failure analysis and characterization of additive friction-stir deposited components – 2022 to Present.
- Poster at JEC World – “Optimizing Construction of Twin-Screw Extruder for Thermoplastic Composites” – 2019.
- Collaborative poster for the Nike Design Challenge – “A Better Method for Recycling Shoes” – 2018.

TEACHING AND MENTORING

- Organized and led group meetings within my research advisor’s group, which included preparing and giving lectures to teach mechanical engineering students about materials science concepts.
- Led multiple events and workshops as president of our UTK chapter for Materials Research Society to encourage community involvement and professional development amongst graduate students.
- Participated in graduate student outreach for three years to tour prospective graduate students at UTK / ORNL and answer their questions about research.
- Trained numerous undergraduate and graduate students, including my replacement for the position at Fulton Bellows, in technical skills related to metallurgical analysis.

REFEREES

Prof. Sudarsanam Suresh Babu PhD Advisor	Department of Materials Science and Engineering, University of Maryland Email: sbabu123@umd.edu, Tel: (301) 405-3637
Prof. Katharine Page PhD Advisor	Department of Materials Science and Engineering, The University of Tennessee, Knoxville Email: kpage10@utk.edu, Tel: (505) 695-1536
Dr. Thomas R. Watkins Technical Advisor	Group Leader & Senior Research Staff, Oak Ridge National Laboratory Email: watkinstr@ornl.gov, Tel: (865) 387-6472