

DISTINGUISHED
STAFF FELLOWS
AT ORNL



Stephen Taller

Alvin M. Weinberg Fellow

Where and when did you earn your PhD?

I earned my PhD in January 2020 from the University of Michigan.

My adviser was Prof. Gary S. Was.

What was the subject of your dissertation?

My dissertation research focused on a key issue in the field of radiation materials science: how accelerated damage rate experiments in the laboratory can capture the relevant processes that occur in structural materials in a nuclear reactor.

What was your dissertation's major contribution to your field?

My dissertation included the first case in which swelling in a candidate alloy irradiated for approximately 2 years in a nuclear reactor was replicated using dual ion irradiation in approximately 1 day with precise control over the damage rate, temperature, and helium injection rate. The isolation of each parameter on cavity evolution provided a guiding "formula" for predicting the complex radiation-induced phenomenon of cavity nucleation and growth at an accelerated damage rate.

Who is your ORNL mentor?

My ORNL mentor is Christian Petrie, Advanced Fuel Fabrication and Instrumentation Group leader.

Which Lab organization are you part of?

I am part of the Nuclear Energy and Fuel Cycle Division within the Fusion and Fission Energy and Science Directorate.

What will your fellowship research focus on?

My fellowship research will focus on ways to shorten the development of an additively manufactured nickel-based alloy for service with nuclear technologies. Specifically, I am working on the development and application of techniques for automating microscopy data acquisition and using machine learning to enhance the understanding of the relationships between the radiation-damaged microstructure observed at the nanoscale and the macroscale mechanical properties of the material using helium trapping at precipitates in additively manufactured nickel-based alloys as an example problem.

What is your project's expected contribution to your field?

My research will increase the knowledge gained per irradiation experiment. Information gained on the precipitating phases will apply to other materials systems, and the techniques developed will help reduce the time spent on PIE (post-irradiation examination).

What are your research interests?

My research interests involve understanding the life-limiting processes for nuclear reactor designs and how the microstructure of a material can be tailored to meet these designs.

What led you to science and your specific discipline?

My interest in science arguably started when I spent hours obsessing over episodes of "The Magic School Bus" as a kid. My interest in nuclear engineering and science was cemented when my high school physics instructor posed a semi-rhetorical question of "Why does the sun shine?" and then lectured on nuclear fusion and fission. I decided to pursue degrees in nuclear engineering to understand how we harness these processes for clean electrical energy and how damage caused at the microscopic level impacts the broader landscape of nuclear energy.

What did you do before coming to ORNL?

I was a graduate student and then a postdoc at the University of Michigan in the Radiation Materials Science group. At the Michigan Ion Beam Laboratory, I designed systems for multiple ion beam irradiation for unprecedented control over the experimental parameters of ion irradiation. I received the Richard and Eleanor Towner Prize for Outstanding PhD Research from the University of Michigan and an Innovations in Nuclear Technology R&D Student Innovator award from the US DOE NE Office of Nuclear Technology R&D.

Could you share an interesting fact or two about yourself?

I feel extremely fortunate to have the family I have. They have been supportive throughout my life. My parents supported my decision to leave home at age 16 and attend a public, residential school to focus on my academics. When my father lost his job during my undergrad years, my parents cashed in their retirement savings and took out loans to make sure my sister and I could finish our degrees. My grandmother and great aunt would rent a beach front condo for a week once a year and invite the entire extended family to spend a week away from everything and stay connected with each other. The amount of love and support I received and continue to receive from my family may be unique to me, but I hope it isn't.

What nonscience topic or activity is important to you and why?

This may be because my sister is a professional musician, but an important topic to me is the role of music and arts in society. I think possibly now more than ever, we need to keep ourselves mentally healthy as well as physically. We can advance technology all we want, but I firmly believe it is the arts that support our collective mental health and advance the emotional state of society.

