

Sean M. Drewry

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Education

University of Tennessee – Knoxville (UTK)

Intended Degree: Doctor of Philosophy, Materials Science and Engineering

Advisor: Dr. Katharine Page

Cumulative GPA: 3.89/4.00

Knoxville, TN

Aug. 2020 – Present

University of Tennessee – Knoxville (UTK)

Master of Science, Nuclear Engineering

Advisor: Dr. Katharine Page

Cumulative GPA: 3.89/4.00

Knoxville, TN

Aug. 2020 – May 2023

Missouri University of Science and Technology (S&T)

Bachelors of Science, Nuclear Engineering

Minor: Mathematics

Cumulative GPA: 3.71/4.00

Rolla, MO

Aug. 2016 – May 2020

Experience

University of Tennessee – Knoxville (UTK)

Graduate Research Assistant

Army Research Laboratory – Materials for Hypersonics

• Investigated carbon-carbon composites for hypersonic flight applications

• Correlated bulk anisotropy of carbon-carbon composites to observed thermal expansion using in-situ high-temperature X-ray diffraction (HT-XRD) and XRD pole figure analysis

• Evaluated the evolution of carbon-carbon microstructure and atomic structure after exposure to high heat flux environments using scanning electron microscopy (SEM) and XRD techniques

NSF Center - Center for Advanced Materials and Manufacturing (CMM)

• Used compositional complexity to design novel ceramic thermal barrier coating systems (TBCs)

• Used cation size disorder in rare earth (RE) titanate pyrochlores ($\text{RE}_2\text{Ti}_2\text{O}_7$) to tune thermophysical and mechanical properties ideal for TBC applications

• Developed an optical dilatometry system using aerodynamic levitation and laser heating for contactless thermal expansion measurements at ultra-high temperatures

DOE-NEUP – Light Water Reactor Sustainability Program

• Performed solid-state synthesis analysis using differential scanning calorimetry (DSC) and in-situ HT-XRD to determine phase formation and of anorthite ($\text{CaAl}_2\text{Si}_2\text{O}_8$) from constituent oxides

• Performed ion irradiations at Los Alamos National Laboratory's IBML using 2 MeV Si^+ ions to study radiation damage effects in anorthite as a model silicate phase for concrete in nuclear reactors

• Characterized evolution of average and local short-range atomic structure of amorphized anorthite using grazing incidence (GI)-XRD, transmission electron microscopy (TEM), and GI- X-ray total scattering for pair distribution function (PDF) analysis

Graduate Teaching Assistant

• MSE 360: Principles and Processing of Ceramic Materials

• MSE 300: Principles of Materials Lab I

• MSE 201: Introduction to Materials Science and Engineering

Laboratory Manager

• Implemented standard operating procedures (SOPs) for lab equipment, identified safety standards for usage, and organized training for new users

• Managed chemical inventory, ordered consumable supplies, and organized hazardous waste disposal

• Maintained laboratory instruments including high temperature furnaces, ultra-high vacuum systems, hydraulic presses, and ceramic powder processing equipment

Knoxville, TN

Aug. 2023 – Present

Aug. 2023 – Present

Aug. 2020 – Aug. 2023

Aug. 2020 – Aug. 2022

Aug. 2020 – Present

Los Alamos National Laboratory (LANL)

Los Alamos, NM

Graduate Research Assistant – Summer Internship

May 2022 – Aug. 2022

Cr-doped UO₂ Fuel for Light Water Nuclear Reactors

May 2023 – Aug. 2023

- Investigated Cr-doped UO₂ as a leading, near-term accident tolerant fuel (ATF) for light water nuclear reactors (LWRs)
- Used microscopy and diffraction techniques to determine correlation of Cr-concentration on average grain size, Cr-oxide formation, residual porosity, lattice parameters, and phase purity of sintered UO₂
- Measured high-temperature thermal diffusivity, heat capacity, and thermal conductivity to determine effects of Cr-concentration on thermophysical properties of UO₂

Missouri University of Science and Technology (S&T)

Rolla, MO

Undergraduate Research Assistant***Two-Group Void Fraction Covariance Correlation***

May 2019 – May 2020

- Updated safety analysis code models for steam-water flows in large diameter pipes to reduce the predictive error of normal operation and accident scenarios in nuclear power reactors
- Analyzed experimental fluid flow data to calculate void fraction and void fraction covariance on nonuniform bubbles in fluid flows
- Incorporated experimental data analysis into predictive two-fluid MATLAB code to reduce the predictive error of void fraction

Radiation Tolerance of Phase Change Materials

Jan. 2019 – May 2019

- Investigated polyethylene wax (PEW) as an alternative to ice in large heat sink condensers systems for nuclear power reactors
- Irradiated PEW with in low-dose neutron and gamma ray environments using the Missouri University of Science & Technology research reactor (MSTR)
- Measured changes in latent heat and melting temperature of irradiated PEW through DSC measurement

Publications and Presentations

Journal Publication:

- **Drewry SM**, Eccles LE, Sickafus KE, Wetteland CJ, Page K (2023) *Preparation of high-density anorthite (CaAl₂Si₂O₈) through solid-state synthesis and uniaxial hot-pressing*. Journal of Materials Science 59: 1184-1195. doi:10.1007/s10853-023-09202-y
- Metz PC, Miller L, Kincaid J, Charles E, Wood AT, Sims ZC, **Drewry SM**, Houston A, et al. *Through-Thickness Microstructure and Residual Stress Distributions in Additive Friction Stir Deposited Aluminum 7075*. (Additive Manufacturing, publication under peer review, 2025).
- Polavaram KC, Evani SK, **Drewry SM**, Rodriguez ET, Alnaggar MG, Wetteland CJ, Page K, Popovics JS, et al. (2024) *Silicon ion radiation as a viable surrogate for emulating neutron radiation damage in silicates*. npj Materials Degradation 8. doi:10.1038/s41529-024-00506-1
- Sickafus KE, Melcher CL, Flynn-Hepford MI, Wang Y, Jaroslaw G, Smith JP, **Drewry SM**, Zhuravleva M (2022) *Crystal chemistry of rare-earth containing garnets: Prospects for high configurational entropy*. Journal of Solid State Chemistry 310. doi:10.1016/j.jssc.2022.122997
- Steere R, Schlegel J, **Drewry S**, Fletcher J, Henke C, Rittenhouse J, Selligman G, Graham J (2025) *Neutron and gamma radiation effects on thermal storage properties of polyethylene wax*. Progress in Nuclear Energy 178. doi:10.1016/j.pnucene.2024.105491
- Swearingen A, **Drewry S**, Schlegel JP, Hibiki T (2022) *Effect of two-group void fraction covariance correlations on interfacial drag predictions for two-fluid model calculations in large diameter pipes*. Experimental and Computational Multiphase Flow 5: 221-231. doi:10.1007/s42757-022-0138-6
- Tanveer R, Windsor D, **Drewry S**, Page K, Xu H, Keppens V, Weber WJ (2024) *Synthesis and properties of rare-earth high-entropy perovskite*. Applied Physics Letters 124. doi:10.1063/5.0206254

- Terricabras AJ, **Drewry SM**, Campbell K, Judge EJ, Byler DD, Teti ES, van Veelen A, Widgeon Paisner S, et al. (2024) *Performance and properties evolution of near-term accident tolerant fuel: Cr-doped UO₂*. Journal of Nuclear Materials 594. doi:10.1016/j.jnucmat.2024.155022
- Tunes MA, **Drewry SM**, Arregui-Mena JD, Picak S, Greaves G, Cattini LB, Pogatscher S, Valdez JA, et al. (2022) *Accelerated radiation tolerance testing of Ti-based MAX phases*. Materials Today Energy 30. doi:10.1016/j.mtener.2022.101186

Presentations:

- **Drewry SM**, Quirinale D, Page K (Mar. 2025) *Thermophysical property measurement of rare earth titanates with aerodynamic levitation and laser heating*. TMS Annual Meeting, Las Vegas, NV.
- **Drewry SM**, Quirinal D, Page K (Aug. 2024) *Aerodynamic levitation and laser heating*. Neutron and X-ray Scattering School, Oak Ridge, TN
- **Drewry SM**, Sickafus KE, Wetteland CJ, Page K (Mar. 2023) *Fundamental ionizing and ballistic radiation effects in multi-component mineral phases*. TMS Annual Meeting, San Diego, CA.
- **Drewry SM**, Page K (Nov. 2022) *Characterization of key ion irradiated minerals*. DOE Light Water Reactor Sustainability (LWRS) Stakeholder Engagement Meeting, Oak Ridge National Laboratory (ORNL), Oak Ridge, TN

Proposals:

- Holliman J, **Drewry SM**, Safin J, Quirinale D, Page K (Mar. 2025) *Atomic segregation in compositionally complex RE zirconate defect-fluorites*. Oak Ridge National Laboratory ORNL, Spallation Neutron Source, BL-1B NOMAD, Oak Ridge, TN
- Safin J, **Drewry SM**, Myers C, Petrova M, Quirinale D, Page K (Nov. 2024) *Distortions in compositionally complex RE titanate pyrochlores*. Oak Ridge National Laboratory ORNL, Spallation Neutron Source, BL-1B NOMAD, Oak Ridge, TN
- **Drewry SM**, Metz P, Page K (Oct. 2023) *Investigation of Ion-Induced Disorder in the Feldspar Mineral Anorthite*. Deutsches Elektronen-Synchrotron DESY, PETRA III, P21.1 High Energy X-Ray Diffraction, Hamburg, Germany
- **Drewry SM**, Sickafus KE, Wetteland CJ, Tajuelo ER, Nishant G, Polavaram K (Aug. 2022) *Nanoscale Expansion and Radiation Damage in Silicates*. Center for Integrated Nanotechnologies (CINT), Los Alamos National Laboratory IBML, Los Alamos, NM

Posters:

- **Drewry SM**, Polavaram K, Nishant G, Page K (Mar. 2024) *Irradiation effects in silicate bearing minerals for nuclear power plant concrete*. TVA Ideas Day, Institute for Advanced Materials and Manufacturing (IAMM), Knoxville, TN
- **Drewry SM**, Terricabras AJ, Kosmidou M, Widgeon Paisner S, Byler DD, White JT (Aug. 2023) *Performance and properties of Cr-UO₂ fuel for light water reactors*. Student Symposium, Los Alamos National Laboratory (LANL), Los Alamos, NM
- **Drewry SM**, Page K, Wetteland CJ, Sickafus KE (Feb. 2022) *Characterization of radiation damage in siliceous minerals with non-destructive X-ray diffraction*. Oak Ridge Chapter ASM Student Night Poster Session, Institute for Advanced Materials and Manufacturing (IAMM), Knoxville, TN

Activities

UTK Materials Research Society (MRS)

Sep. 2022 – Present

Executive Board Member

- Organized annual UTK-MRS “Science as Art” competition for students and faculty members at UTK campus
- Volunteered for social outreach events including UTK Engineer’s Day, MSE graduate recruitment tours, and MRS group hikes

Undergraduate Mentorship

Aug. 2020 – Present

Graduate Research Assistant

- Assisted an MSE senior design team investigating sintering behavior of injection molded alumina bars using high temperature dilatometer
- Mentored West Point Cadet through the Academic Individual Advanced Development (AIAD) program. Developed a 6-week summer research plan to investigate the sintered microstructures of rare earth titanates using XRD and SEM. Research results culminated in a poster presentation given by the cadet for the ARL-USMA Technical Symposium (AUTS)
- Guided an undergraduate research assistant through a year-long project investigating solid-state synthesis of anorthite. The undergraduate presented results at UTK's Exhibition of Undergraduate Research and Creative Achievements (EURECA) showcase and published an article in Pursuit – The Journal of Undergraduate Research at UTK

Tennessee State Science Olympiad

Dec. 2022 – Apr. 2023

Exam Organizer

- Wrote and proctored the “Crave the Wave” exam covering the physics of wave propagation
- Created hands-on experiment for practical examination of light refraction knowledge

Tennessee's Governors School for Science and Engineering

June 2021

Graduate Teaching Assistant

- Instructed a basic materials science and engineering course for rising high school junior and senior students
- Lead a hands-on laboratory section demonstrating basic ceramic processing concepts through the synthesis and characterization of MgCo_2O_4 spinel

Capstone Design Project (100kW Lunar Surface Reactor)

Aug. 2019 – May 2020

Group Member

- Design and model the cooling and power generation systems for HECTO-KORR which consisted of liquid sodium heat-pipes and beta-cycle Stirling engines

Missouri S&T American Nuclear Society

Fall 2019 – Spring 2020

Executive Board Member

- Organized yearly attendance of Nuclear Engineering senior design teams at the ANS National Student Conference to present their results
- Updated the S&T ANS chapter's webpage and other social media with newsletters and announcements for upcoming events and general body meetings
- Organized outreach events such as the Nuclear Science Summer Camp, Boy Scout's nuclear science merit badge weekend, and Blue Glow Tours of the S&T test reactor to educate the public on the various applications of nuclear science

Instrumentational Techniques/Miscellaneous

- *Ceramic Processing*: Comminution (High Energy Ball Milling/Speedmixing, Powder Sieving), Sintering (Pressing and Tube Furnace Sintering, Reactive Hot-Pressing, and SPS)
- *Characterization*: Electron Microscopy (SEM, SEM-FIB, SEM-EDXS, SEM-EBSD, STEM/TEM, STEM-EDXS, STEM-EELS, SAED, and CBED), Diffraction Analysis (PXRD, GIXRD, In-Situ High-Temperature-XRD, Pole Figure Analysis, Synchrotron Total Scattering, Neutron Total Scattering), Metallographic Sample Preparation, Thermophysical Characterization (DSC/TGA, dilatometer, LFA, and TPS), Nanoindentation
- *Software*: Python, Autodesk Fusion 360, Mathcad, SRIM, GSAS-II, PDFgetX, PDFgui, and CrystalMaker Suite

Awards and Scholarships

- **Graduate Student Senate Travel Support** – Awarded 2023

- **Materials Science and Engineering Department Travel Support** – Awarded 2023
- **Nuclear Regulatory Commission (NRC) Nuclear Education Scholarship** – Awarded 2019-2020
- **William E. Burchill Nuclear Engineering Scholarship** – Awarded 2019-2020
- **Missouri S&T Trustees Scholarship** – Awarded 2016-2020