William Forrest Drayer

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Education

University of South Florida 2018–2023

- Ph.D., Chemical Engineering
  - Dissertation title: Dynamical Polymer Chain Heterogeneities and Their Impacts on the Glass Transition

University of Akron 2013–2018

- B.A., Multidisciplinary Studies
  - Primary concentration: Mathematics
  - Secondary concentration: Physical Chemistry
  - Minors: Polymer Science and Engineering; Music

Work

University of Pennsylvania 2023–Present

School of Engineering and Applied Science; Materials Science and Engineering
Postdoctoral Researcher (in collaboration with Sandia National Labs)

- Investigating hydroxide and chloride solvation and transport in hydrated, precise polymer electrolytes
- Refined structure factor calculations to achieve agreement between simulation and experiment
- Created a forcefield for simulating new precise polymer membranes with experimental analogues
- Supervised four undergraduate researchers
- Assisted in Department of Energy grant renewal

University of South Florida 2018–2023

Department of Chemical, Biological, and Materials Engineering
Teaching Associate; Research and Teaching Assistant

- Lead instructor for Thermodynamics I (Fall 2022)
- Teaching assistant for three semesters of thermodynamics (I and II)
- Theoretical investigations on the glass transition (particularly in polymers)
  - Reinstated and updated in-house job submission software and version control
  - Extensive use of high-performance/distributed computing (SLURM, Bash, C++, CUDA)
  - Project development and management with Git/Github (previously Apache Subversion)
  - Data analysis and visualization using Excel, Python, Julia, MATLAB, and Mathematica
- Lab safety and instrument calibration and maintenance (GPC and rheometer)

University of Akron 2015–2018

Department of Polymer Engineering; Undergraduate Research

- Investigating dynamics of bead-spring copolymers

Department of Corrosion Engineering; Research Assistant

- Developed a class for predicting damage to capsule-embedded coatings in Python (Anaconda)
- Simulated coating damage and analyzed self-healing performance for application in anti-corrosive coatings

NASA Glenn Research Center 2015 Summer

Ballistic Impact Lab; Research Assistant

- Refabricated Hopkinson tube for high-speed impact measurements
- Selected and installed strain gauge and appropriate adhesive
- Prepared ballistic gelatin for impact testing
- Operated high-speed impact data collection
- Tensile testing on carbon fiber samples

Publications and Conferences

Publications

In Prep Amorphous Molecular Dynamics Analysis Toolkit: AMDAT; David S. Simmons, William F. Drayer, Pierre Kawak, and others; DOI: 10.5281/zenodo.17417166

2025 Investigating Water Channel Structure and Diffusion in Simulations of Anion Exchange Membranes with Two Precise Polymers; William F. Drayer, Emily M. Duan, James C. Johnson, Karen I. Winey, Amalie L. Frischknecht; DOI: 10.1021/acs.macromol.5c01789

2025 Effect of Sulfonation Level on the Percolated Morphology and Proton Conductivity of Hydrated Fluorine-Free Copolymers: Experiments & Simulations; Sol Mi Oh, Victoria Lee, William F. Drayer, Max S. Win, Lindsay F. Jones, Courtney M. Leo, Justin G. Kennemur, Amalie L. Frischknecht, Karen I. Winey; DOI: 10.1021/jacsau.5c00218

2024 Is the Molecular Weight Dependence of the Glass Transition Temperature Caused by a Chain End Effect?; William F. Drayer and David S. Simmons; DOI: 10.1021/acs.macromol.4c00419

2023 Interplay between Dynamic Heterogeneity and Interfacial Gradients in a Model Polymer Film; Austin D. Hartley, William F. Drayer, Asieh Ghanekarade, and David S. Simmons; DOI: 10.1063/5.0165650

2022 Sequence Effects on the Glass Transition of a Model Copolymer System; William F. Drayer and David S. Simmons; DOI: 10.1021/acs.macromol.2c00664

Presentations

2025 Drayer, W., Winey, K., and Frischknecht, A. Channel morphologies and aqueous dynamics in simulations of anion exchange membranes. In APS March Meeting Abstracts (Vol. 2025).

2024 Drayer, W. and Simmons, D. Evidence for Two Mechanisms Driving Molecular Weight Dependence of the Glass Transition Temperature in Linear Polymers. In APS March Meeting Abstracts (Vol. 2024, pp. D32.00007).

2023 Drayer, W. and Simmons, D. Mechanistic Origins of Glass Transition Dependence on Molecular Weight in Linear Homopolymers. In APS March Meeting Abstracts (Vol. 2023, pp. K23.00005).

2022 Drayer, W. and Simmons, D. Computational Insights into the Molecular Origins of the Chain Length Dependence of Polymers' Glass Transition. In APS March Meeting Abstracts (Vol. 2022, pp. Y16.008).

2021 Drayer, W. and Simmons, D. Sequence Effects on the Glass Transition - Suppression from Block to Alternating Copolymers. In APS March Meeting Abstracts (Vol. 2021, pp. S08-005).

2019 Drayer, W. and Simmons, D. Polymer chain sequence effects on the glass transition. In APS March Meeting Abstracts (Vol. 2019, pp. P54-001).

Posters

2024 William F. Drayer, Emily Duan, James Johnson, Karen I. Winey, Amalie L. Frischknecht. Nanoscale Structure and Water Dynamics in Precisely Quaternized Polymers; Polymer Physics GRC

Technical Proficiencies

Programming Languages:

Julia	Python	Bash	Powershell
C++	Mathematica	MATLAB	Java

Technical Software Experience:

Git (Github) | CUDA (C & Julia) | LAMMPS | SLURM | Anaconda (Python Suite)

Highlighted Material Characterization Techniques:

- Differential scanning calorimetry (DSC)
- Size-exclusion chromatography (SEC)
- X-ray diffraction (XRD)
- Electrochemical impedance spectroscopy (EIS)
- Rheology

Awards and Other Work Experience

Selected Awards:

- Macromolecules Volume 58, Issue 18 Supplemental Cover Art (2025)
- USF Outstanding Teaching Assistant Award (2022)
- USF Outstanding Departmental Contribution Award (2021)

Professional Bassoonist:

- Canton Concert Band, 2012-2018
- Alliance Symphony Orchestra, Spring 2012-Spring 2014, Spring 2018
- University of Akron, Fall 2013-Spring 2017
- Ohio Band Director's Conference, Spring 2016
- Kent State Stark Band, Spring 2012-Spring 2014

Laborer:

- Groundskeeping (2012-2014)
  - Sanctuary Golf Course (bunker maintenance and repair, mowing, edge-trimming, greenskeeping, etc.)
  - University of Akron (landscape maintenance)
- Farmhand (Summer 2011)