




SINCLAIR R. COMBS

☎ (425) 890-2621 | ✉ sinclaircombs@mines.edu | 📍 Golden, CO, 80401 |  [Google Scholar](#) |  [LinkedIn](#) |  0000-0002-8982-0288

SUMMARY STATEMENT

I am a self-driven, dedicated, and curious individual working in solid-state materials chemistry research for next-generation battery applications. My educational background includes a B.S. in chemistry and a B.A. in mathematics. Currently, I am an applied chemistry Ph.D. candidate at Colorado School of Mines and work collaboratively at the National Renewable Energy Laboratory. My research aims to design and characterize solid-state inorganic lithium-ion conductors, focusing on the crystallography of disordered materials, atomic-scale ion transport properties, and improvement of electrochemical stability for high-energy-density battery applications.

CORE QUALIFICATIONS

- 🍃 Research experience in solid-state chemistry for next-generation energy storage materials discovery
- 🍃 Solid-state synthesis in air-free environments, including mechanochemical methods
- 🍃 Crystallographic analysis, with a focus on highly-disordered and complex crystal systems (i.e., high defect concentration, planar disorder, etc.)
- 🍃 X-ray diffraction and total scattering techniques for structural characterization
- 🍃 Electrochemical measurement techniques, such as electrochemical impedance spectroscopy, galvanostatic cycling, and chronoamperometry
- 🍃 Specialized structure modeling software development in the Python programming language; additional experience with TeX, Java, R, and C/C++
- 🍃 Advanced mathematical experience with differential equations and group theory
- 🍃 Extensive teaching, mentoring, and cross-discipline collaborative experience


EDUCATION

Ph.D., Applied Chemistry, in progress	Expected 2026
Colorado School of Mines	Golden, CO
<i>“Disordered materials design of metal halide ion conductors for all-solid-state battery applications”</i>	
(Advisor: Dr. Annalise E. Maughan)	

Bachelor of Science, Chemistry	May 2021
Pacific Lutheran University	Tacoma, WA
<i>Cum Laude</i> , Departmental Honors	
<i>“Blending electronic & ionic conductive polymers for use in p-doped organic electrochemical transistors”</i>	
(Advisor: Dr. Dean Waldow)	

Bachelor of Arts, Mathematics	May 2021
Pacific Lutheran University	Tacoma, WA
<i>Cum Laude</i> , Departmental Honors	
<i>“Derivations of the Schrödinger equation in multiple dimensions and coordinate systems”</i>	
(Advisor: Dr. Daniel J. Heath)	

SINCLAIR R. COMBS

☎ (425) 890-2621 | ✉ sinclaircombs@mines.edu | 📍 Golden, CO, 80401 |  [Google Scholar](#) |  [LinkedIn](#) |  0000-0002-8982-0288

RESEARCH EXPERIENCE

Graduate Research Assistant

Oct 2021 - Current

Maughan Lab, Department of Chemistry, Colorado School of Mines
National Renewable Energy Laboratory

Golden, CO
Golden, CO

- Solid-state materials design and synthesis of ternary metal halide lithium-ion conductors guided by first-principles predictive calculations
- Detailed structural analysis of highly-disordered crystal structures, including characterization of point defects and planar disorder
- X-ray total scattering techniques in polycrystalline materials (i.e., XRD, PDF)
- Software design (Python) for planar disorder modeling in non-layered crystal systems informed by diffraction measurements
- Ion transport property measurement and characterization using electrochemical techniques (i.e., impedance spectroscopy, potentiometry, galvanostatic cycling, etc.)

Undergraduate Research Assistant

July 2020 - May 2021

Waldow Lab, Department of Chemistry, Pacific Lutheran University

Tacoma, WA

- Blending electronically-conductive P3HT polymers and novel block co-polymer ion conductors for use as the active semiconductor layer in organic electrochemical transistors
- Design and synthesis of solid-state single-ion conducting block co-polymers for lithium-ion battery applications
- Collaboration with Dr. David Ginger research group at the University of Washington.

Advanced Organic Laboratory

Jan 2020

Department of Chemistry, Pacific Lutheran University

Tacoma, WA

Completion of two total organic synthesis project over a 4-week timeframe – polymerization, Grignard reagent synthesis for carbon-carbon bond formation

Organic Special Projects Laboratory

Feb 2019 - May 2019

Department of Chemistry, Pacific Lutheran University

Tacoma, WA

Development of professional-level organic synthesis and methodology development of pre-cursor organics for solid-state polymerization.

ADVANCED EXPERIMENTAL EXPERIENCE

HFIR HB-2A Neutron Powder Diffractometer

January 2024

High Flux Isotope Reactor, Oak Ridge National Laboratory

Utilizing high-resolution neutron powder diffraction to probe structural and dynamical changes of the lithium sublattice as a function of aliovalent substitution fraction in metal halide materials
(*Proposal Title: Evolution of the Li sublattice upon substitution in Li_3MCl_6*)



APS Beamline 11-ID-B

Dec 2022

Advanced Photon Source, Argonne National Laboratory

Performing *operando* total scattering measurements on substituted metal halides to understand

SINCLAIR R. COMBS

☎ (425) 890-2621 | ✉ sinclaircombs@mines.edu | 📍 Golden, CO, 80401 |  [Google Scholar](#) |  [LinkedIn](#) |  0000-0002-8982-0288

how local structure of the bulk solid electrolyte dynamically evolves during electrochemical cycling
(*Proposal Title: Operando XPDF: Cycling-induced local structure rearrangement of bulk substituted metal halide solid electrolytes*)

APS Beamline 11-BM-B

July 2022; April 2023

Advanced Photon Source, Argonne National Laboratory

Utilizing high-resolution X-ray powder diffraction to reveal detailed disordered structures as a function of amount of chemical substitution into parent A_3MX_6 solid electrolyte materials

(*Proposal Title: Aliovalent Substitution of Ternary Metal Halide (A_3MX_6) Materials*)

TEACHING EXPERIENCE

Mines Chemists Who Code

May 2024 - Current

Colorado School of Mines

Golden, CO

Monthly open office hours for graduate students to get help with coding-related questions and projects in order to aid their research.

Mines Chemistry Python Workshop

Aug. 2024; Sept. 2025; Oct. 2025

Department of Chemistry, Colorado School of Mines

Golden, CO

Created materials for and taught introductory Python skills to other chemistry graduate students.

Private Algebra Tutor

March 2025 - Current

Self-Employment

Remote

Live Help Science & Math Tutor

July 2022 - September 2023

Paper Education America Inc.

Remote

Chemistry Lab Teaching Assistant

Aug 2021 - May 2022

Department of Chemistry, Colorado School of Mines

Golden, CO

Courses: Principles of Chemistry I and II (CHGN 121 and 122)

Private STEM Tutor

Dec 2020 - July 2021

A Little Creative LLC.; Self-Employment

Tacoma, WA

Math Coursework Grader

Sep 2020 - May 2021

Department of Mathematics, Pacific Lutheran University

Tacoma, WA

Courses: Introduction to Proofs (MATH 317)

Chemistry Lab Teaching Assistant

Sep 2018 - May 2021

Department of Chemistry, Pacific Lutheran University

Tacoma, WA

Courses: Chemistry of Life, General Chemistry I, Organic Chemistry I, Organic Special Projects Laboratory, and Physical Chemistry I – Thermodynamics

OTHER WORK EXPERIENCE

Library Circulation Desk Assistant

Sep 2018 - May 2021

Mortvedt Library, Pacific Lutheran University

Tacoma, WA

Aide & Assistant Teacher for Summer Camps

Jun 2018 - Aug 2018

Youth & Family Programs, Pacific Science Center

Seattle, WA

SINCLAIR R. COMBS

☎ (425) 890-2621 | ✉ sinclaircombs@mines.edu | 📍 Golden, CO, 80401 |  [Google Scholar](#) |  [LinkedIn](#) |  0000-0002-8982-0288

VOLUNTEER EXPERIENCE

Colorado Reptile Human Society (CORHS)

Shelter Volunteer

Bright MINDS (Multisensory Intensive Dyslexia Support) Program

Middle School Dyslexia Outreach Panel Volunteer

PUBLICATIONS & PRESENTATIONS

Berquist, Z.; **Combs, S.R.**; Maughan, A.E.; Teeter, G. “Virtual electrode XPS experiments on $\text{Li}_{3-x}\text{Sc}_{1-x}\text{Zr}_x\text{Cl}_6$ ($x \approx 0.3$): Oxygen-mediated interface passivation on metallic lithium anodes” *ACS Appl. Mater. Interfaces*. *In Review*.

Rom, C.L.; Shotwell, A.M.; **Combs, S.R.**; Peters, A.; Borgia, L.; Neilson, J.R.; Maughan, A.E. “Ball milling enables phase-pure synthesis of a temperature sensitive ternary chloride, MgZrCl_6 ” *RSC Mechanochem*. *In Review*.

Combs, S.R.; Maughan, A.E. “PyFaults: A Python Tool for Stacking Fault Screening” *J. Appl. Cryst.*, **2024**, *57*, 1996-2009. [[doi](#)]

Combs, S.R.; Todd, P.K.; Gorai, P.; Maughan, A.E. “Editors’ Choice—Review—Designing Defects and Diffusion through Substitutions in Metal Halide Solid Electrolytes” *J. Electrochem. Soc.*, **2022**, *169*, 040551. [[doi](#)]

Combs, S.R.; Rai, M.; Maughan, A.E. ‘*PyFaults*: a Python tool for stacking fault screening”, **US Research Software Sustainability Institute Software School** (2025).

Combs, S.R.; Rai, M.; Maughan, A.E. ‘*PyFaults*: a Python tool for stacking fault screening”, **SciPy Conference** (2025).

Combs, S.R.; Maughan, A.E. “Examining the Li metal interface evolution in Li_3MCl_6 solid electrolytes”, **Mines Graduate Research & Discovery Symposium** (2025).

Combs, S.R. Micro-talk: “From Lab to Laptop”, **US-RSE Conference** (2024).

Combs, S.R.; Maughan, A.E. “Influence of stacking disorder on ion conduction mechanisms in ternary metal halide solid-state electrolytes”, **ACS Fall 2024 Conference** (2024).



Combs, S.R.; Maughan, A.E. “Doubling Defect Dimensionality: Modeling Stacking Faults in Metal Halide Li-Ion Conductors”, **ID4 All-Hands Meeting, Harvard University** (2024).

Combs, S.R.; Maughan, A.E. “Doubling Defect Dimensionality: Modeling 2-D Stacking Disorder in Metal Halide Ion Conductors”, **ACS Rocky Mountain Regional Meeting** (2023).

Combs, S.R.; Maughan, A.E. “Expanding Defect Dimensionality: Modeling Stacking Faults in Metal Halide Li-ion Conductors”, **Colorado Center for Advanced Ceramics Conference** (2023).

Combs, S.R.; Gorai, P.; Maughan, A.E. “Disordered Materials Design of Metal Halide Solid

SINCLAIR R. COMBS

📞 (425) 890-2621 | ✉️ sinclaircombs@mines.edu | 📍 Golden, CO, 80401 |  [Google Scholar](#) |  [LinkedIn](#) |  0000-0002-8982-0288

Electrolytes for Fast Ion Conduction in All-Solid-State Batteries”, **Mines Graduate Research & Discovery Symposium** (2023) and **ADSE Young Researcher Conference** (2023).

Combs, S.R.; Gorai, P.; Maughan, A.E. “Disordered Materials Design of Metal Halide Solid Electrolytes for Fast Ion Conduction”, **Rocky Mountain Solid State Chemistry Workshop** (2023).

Combs, S.R.; Gorai, P.; Maughan, A.E. “Defect Studies in Halide Solid Electrolytes for High-Voltage Battery Applications”, **C3E Women in Clean Energy Symposium** (2022).

Combs, S.R.; Gorai, P.; Maughan, A.E. “Defect Studies in Solid Halide Electrolyte Materials for High-Voltage Battery Applications”, **Mines Graduate Research & Discovery Symposium** (2022).

Combs, S.R.; Waldow, D.A. “Blending electronic and ionic conductive polymers for use in p-doped organic electrochemical transistors”, **ACS Conference for Undergraduate Research** (2021) and **Murdock College Science Research Conference** (2021).

FELLOWSHIPS, HONORS & AWARDS

Outstanding Young Woman College Student In STEM Award Nominee March 2024
9th Annual Colorado Women’s Day, IX Power Foundation

Best-Judged Talk Awardee August 2023
Colorado Center for Advanced Ceramics Conference, Colorado School of Mines

2nd Place Poster in Environment & Energy Research April 2023
Graduate Research & Discovery Symposium, Colorado School of Mines

Poster Presentation Awardee Jan 2023
Rocky Mountain Solid State Chemistry Workshop; University of Colorado, Boulder

NSF Institute for Data Driven Dynamical Design (ID4) Fellowship April 2022
Colorado School of Mines

2nd Place Poster in Environment & Energy Research April 2022
Graduate Research & Discovery Symposium, Colorado School of Mines

ACS Outstanding Organic Chemistry Senior May 2021
Department of Chemistry, Pacific Lutheran University

Dean’s List Spring 2018, Fall 2019, Spring 2020
Pacific Lutheran University

LANGUAGES

English

Native Speaker

Norwegian

Working Proficiency