

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, hardworking individual with a strong background in fundamental chemistry and applied mathematics. I hold a B.S. in chemistry, having done research on semiconducting polymers, and a B.A. in mathematics focused on differential equation derivations of quantum mechanical concepts. Currently, I am a Ph.D. student at Colorado School of Mines, advised by Dr. Annalise Maughan, researching solid-state inorganic ion conductors for high-voltage battery applications. My research interests revolve around highly-disordered materials, crystallographic characterization techniques, and atomic-scale dynamic processes.

CORE QUALIFICATIONS

- 🌱 Academic research in inorganic materials chemistry for Li-ion battery applications
- 🌱 Solid-state and air-free synthesis methods
- 🌱 Collection and analysis of crystallographic and electrochemical data
- 🌱 Focus on highly-disordered and complex crystal systems
- 🌱 High-level math background, particularly in differential equations and group theory
- 🌱 Mentoring experience and collaborative skills
- 🌱 Programming Languages: Python, TeX, Java, C/C++

EDUCATION

Ph.D. in Chemistry, in progress Expected 2026
Colorado School of Mines Golden, CO
“Disordered materials design of metal halide solid electrolytes for fast ion conduction in all-solid-state battery applications” (Advisor: Dr. Annalise Maughan)

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

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

RESEARCH EXPERIENCE

Graduate Research Assistant Oct 2021 - Current
Maughan Lab, Department of Chemistry, Colorado School of Mines Golden, CO
National Renewable Energy Laboratory Golden, CO

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- Solid-state materials synthesis using first-principles predictions of ternary metal halide solid-state electrolyte candidates.
- Utilizing aliovalent substitution to induce structural changes beneficial to ionic conductivity and overall stability.
- Examining crystallographic defects and how they pertain to ion transport properties.
- Characterizing structure and electrochemical properties via XRD, total scattering techniques, EIS, and *operando* cycling measurements.

Undergraduate Research Assistant

July 2020 - May 2021

Waldow Lab, Department of Chemistry, Pacific Lutheran University

Tacoma, WA

- Blending electronically conductive P3HT polymer and ionically conductive novel block co-polymer for use as an active layer semiconducting channel in organic electrochemical transistors.
- Design and synthesis of single-ion conducting block co-polymers for solid-state lithium-ion battery applications.
- Collaboration with David Ginger at University of Washington.

Advanced Organic Laboratory Student

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

Special Projects Organic Laboratory Student

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

Upcoming Sep 2023 - Jan 2024 Cycle

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 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*)

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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

Chemistry Lab Teaching Assistant

Aug 2021 - May 2022

Department of Chemistry, Colorado School of Mines

Golden, CO

CHGN 121: Principles of Chemistry I

CHGN 122: Principles of Chemistry II

Private Tutor

Dec 2020 - July 2021

A Little Creative LLC.; Independent

Tacoma, WA

Subjects: Physical Sciences and Math

Math Coursework Grader

Sep 2020 - May 2021

Department of Mathematics, Pacific Lutheran University

Tacoma, WA

MATH 317: Introduction to Proofs

Chemistry Lab Teaching Assistant

Sep 2018 - May 2021

Department of Chemistry, Pacific Lutheran University

Tacoma, WA

CHEM 105: Chemistry of Life

CHEM 115: General Chemistry I

CHEM 331: Organic Chemistry I

CHEM 336: Organic Special Projects Laboratory

CHEM 341: Physical Chemistry (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

VOLUNTEER EXPERIENCE

Colorado Reptile Human Society (CORHS)

Shelter Volunteer

Bright MINDS (Multisensory Intensive Dyslexia Support) Program

Middle School Dyslexia Outreach Panel Volunteer

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PUBLICATIONS & PRESENTATIONS

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

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

PROFESSION RELEVANT SKILLS

🍃 Expertise using instruments and equipment such as X-ray diffractometers, gloveboxes, potentiostats, solid-state electrochemical cells, and flame-sealing lines.

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- 🌱 Expertise characterizing data such as diffraction patterns, pair distribution functions, electrochemical impedance spectra, and chronopotentiometry potential-time curves.
- 🌱 Close collaboration with computational experts for targeted materials design
- 🌱 Comfortable using technology (i.e., computers, databases, software systems) in a laboratory setting
- 🌱 Adaptability and flexibility with learning new techniques and/or software packages
- 🌱 Clear communicator and confident presenter, particularly visual communication
- 🌱 Ability to convey complex concepts to a broad scope of audiences beyond scientific peers (i.e., non-science professionals, undergraduates, K-12 students, etc.)
- 🌱 Records and data management

LANGUAGES

English



Native Speaker

Norwegian



Limited Working Proficiency