

Education

Stanford University Palo Alto, CA Postdoctoral Research Fellow	2021-Present
University of California, Davis Davis, CA Ph.D. <i>Inorganic Chemistry</i>	2016 – 2021
Linfield College McMinnville, OR B.S. <i>magna cum laude Majors: Chemistry (ACS Certified) and Mathematics</i>	2012 – 2016

Research Experience

Stanford University Advisor: Dr. Thomas F. Jaramillo <u>Postdoctoral Researcher</u> : Synthesis and characterization of mixed-metal alloys and oxides for thermal catalysis applications. Seawater electrolyzer system and component design, process optimization.	2021-Present
University of California, Davis Advisor: Dr. Jesús M. Velázquez <u>Graduate Student Researcher</u> : Development of structure-function correlations for metal chalcogenide electrocatalyst materials through synthesis, structural analysis, and electrochemical characterization. Fabrication of nano-structured semiconductors for photocatalytic applications.	2016 – 2021
Stanford Synchrotron Radiation Lightsource (SSRL), Palo Alto, CA <u>Junior Research Scientist</u> : Design and performance of <i>ex-situ</i> and <i>operando</i> X-ray absorption, diffraction, and photoelectron spectroscopy experiments. Synchrotron experiment data processing.	2017 – 2021
University of California, Davis Advanced Materials Characterization and Testing Facility <u>Super-User</u> : Operation, parameter optimization, and new-user training for Kratos Supra Axis X-ray photoelectron spectrometer with surface-science gas dosing station and variable-temperature stage.	2017 – 2021
University of California, Davis Center for Nano and Micro Manufacturing <u>Process Engineer</u> : Utilization of clean-room wet chemical area for nano-fabrication pre-treatment processes. Operation of profilometer and four-gun magnetron sputter-coating thin film deposition system.	2016 –2021
Linfield College, McMinnville, OR Advisor: Dr. Elizabeth J. O. Atkinson <u>Undergraduate Student Researcher</u> : Physical characterization of novel organosilyl-modified polyoxometalates via Langmuir-Blodgett and fluorescence microscopy.	2014 – 2 016

Awards and Achievements

UC Davis Outstanding Fellowship Award	2021
Susan M. Kauzlarich Graduate Student in Inorganic Chemistry Fellow	2020 – Present
Earnest E. Hill Memorial Graduate Student Fellow	2020 – Present
Department of Defense SMART Fellowship Semifinalist	2018
Chevron Energy Fellow	2017 – Present
Fred P. Corson/Dow Chemical Fellow	2017 – Present
Bradford Borge Graduate Fellow	2016 – Present
D.S. and E.Z. Taylor Chemistry Scholarship recipient	2014, 2015
Linfield College Grant recipient	2012 – 2016
Linfield College Trustee Scholarship recipient	2012-2016
United States Army Scholar-Athlete Award recipient	2012

Elks Foundation Most Valuable Student Award recipient

2012

Technical Experience

Synthesis Methods:

Chemical Vapor Deposition (CVD, MOCVD)
Hydrothermal / High Pressure
Microwave-Assisted Solid-State (Inert Atmosphere)
High-Temperature Solid-State (Inert Atmosphere)

Electrochemical Characterization:

Chronoamperometry
Chronopotentiometry
Linear Sweep / Cyclic Voltammetry
Potentiostatic Electrochemical Impedance
Spectroscopy (PEIS)

Materials Characterization:

Ambient Pressure X-ray Photoelectron Spectroscopy (APXPS)
Scanning Electron Microscopy (SEM)
High-Resolution Transmission Electron Microscopy (HRTEM)
Fluorescence / Optical Microscopy
Ultra-Violet / Visible Light Spectroscopy
Raman Spectroscopy
Fourier-Transform Infra-Red Spectroscopy (FTIR)
Attenuated Total Reflection Infra-Red Spectroscopy (ATR-IR)

Thin Film Fabrication:

Magnetron Sputter Coating
Evaporative Sputter Coating
Spin Coating
Electrodeposition
Langmuir-Blodgett Deposition

Chromatography:

High-Performance Liquid Chromatography (HPLC)
Gas Chromatography

- Thermal Conductivity Detection (GC-TCD)
- Flame Ionization Detection (GC-FID)
- Mass Spectrometry (GC-MS)

Energy Dispersive X-Ray Spectroscopy (EDX)
X-Ray Photoelectron Spectroscopy (XPS)
X-Ray Absorption Spectroscopy (XAS)
Synchrotron X-Ray Diffraction (XRD)
Powder X-Ray Diffraction (PXRD)
Selected Area Electron Diffraction (SAED)
Profilometry

Extra-Curricular Activities

Member of the Materials Research Society	2019 – Present
Volunteer with UC Davis Chemistry Department Outreach	2017 – 2020
Member of the American Chemical Society	2014 – Present
Four-Year NCAA Athlete	2013 – 2016
Member of Linfield College Pi Mu Epsilon Mathematics Honor Society	2015 – 2016
Secretary of the Linfield College Society for Undergraduate Chemists	2016
Member of the American Mathematics Association	2016

Outreach Activities

University of California, Davis McNair Scholars Program Mentor:**2018**

- Graduate mentor to Treasure Warren (Jr., University of California, Davis) on project related to elucidating catalytic stability of metal chalcogenides in extreme pH conditions for the electrochemical reduction of CO₂ and CO

University of California, Davis NSF-REU Program Mentor:**2017 – 2018**

- Graduate mentor to Sarah J. Jones (Sr., Pomona College) on individual summer research project synthesizing and characterizing new ternary selenide and telluride phases based on molybdenum for energy conversion catalysis and battery applications.
- Graduate mentor to Malak Z. Haidari (Jr., University of California, Berkeley) on individual summer research project synthesizing and characterizing ternary thiospinel-phase electrocatalysts for electrochemical production of C₁-C₃ alcohols.
- Graduate mentor to Jessica C. Ortiz-Rodriguez (Sr., University of Puerto Rico, Cayey) on individual summer research project synthesizing and characterizing Chevrel-phase molybdenum sulfide electrocatalysts for selective production of methanol from CO₂.

University of California, Davis Young Scholars Program Volunteer:**2017**

- Provided scanning electron microscope demonstrations otherwise unavailable to high-school and undergraduate students.
- Participated in electrocatalysis and photo-electrocatalysis demonstrations and question-answer sessions with summer science school students.

Linfield College Chemical Outreach Coordinator:**2016**

- Coordinated chemical demonstrations for elementary-age students through local school district representatives.
- Performed age-appropriate chemistry demonstration for 1st - 3rd grade classes to spark interest in physical sciences.

Teaching Experience**Linfield College: McMinnville, OR****2013 – 2016**

- CHEM 210: General Chemistry (Stoichiometry and Equilibria)
- CHEM 211: General Chemistry (Kinetics and Thermodynamics)
- Learning Support Services: Personal Tutor (General and Organic Chemistry)

University of California, Davis**2016 – 2021**

- CHEM 2A: General Chemistry (Atomic Theory, Kinetic Theory of Gases, Periodicity)
- CHEM 2B: General Chemistry (Kinetics and Thermodynamics)
- CHEM 2C: General Chemistry (Thermodynamics, Inorganic Chemistry, Organic Chemistry)
- CHEM 201: Symmetry and Group Theory (Vibrational Spectroscopy for Graduate Students)
- CHEM 228D: Homogeneous and Heterogeneous Catalysis (Catalysis for Graduate Students)

Publications

1. Nicholas R. Singstock; Jessica C. Ortiz-Rodríguez; **Joseph T. Perryman**; Christopher Sutton; Jesús M. Velázquez; Charles B. Musgrave. "Machine Learning Guided synthesis of Multinary Chevrel Phase Chalcogenides." *Journal of the American Chemical Society* **2021**, 143, 24, 9113-9122.
2. Kristina Lilova*; **Joseph T. Perryman***; Nicholas R. Singstock*; Mykola Abramchuk; Tamilarasan Subramani; Andy Lam; Ray Yoo; Jessica C. Ortiz-Rodríguez; Charles B. Musgrave, Alexandra Navrotsky; Jesús M. Velázquez. "A Synergistic Approach to Unraveling the Thermodynamic Stability of Binary and Ternary Chevrel Phase Sulfides." *Chemistry of Materials* **2020**, 32, 16, 7044-7051.
3. Jessica C. Ortiz-Rodríguez*; Nicholas R. Singstock*; **Joseph T. Perryman**; Forrest P. Hyler; Sara J. Jones; Aaron M. Holder; Charles B. Musgrave; Jesús M. Velázquez, "Stabilizing Hydrogen Adsorption through Theory-Guided Chalcogen Substitution in Chevrel-Phase Mo₆X₈ (X=S, Se, Te) Electrocatalysts." *ACS Applied Materials and Interfaces* **2020**, 12, 32, 35995-36003.
4. **Joseph T. Perryman**; Ambarish R. Kulkarni; Jesús M. Velázquez. "Direct Solid-State Nucleation and Charge-Transport Dynamics of Alkali Metal-Intercalated M₂Mo₆S₆ (M = K, Rb, Cs) Nanorods." *Journal of Materials Chemistry C* **2020**, 8, 10742-10748 (**Featured on back cover of 2020 Emerging Investigator Themed Issue**).
5. **Joseph T. Perryman**; Jessica C. Ortiz-Rodríguez; Joshua W. Jude; Forrest P. Hyler; Ryan C. Davis; Apurva Mehta; Ambarish R. Kulkarni; Christopher J. Patridge; Jesús M. Velázquez. "Metal Promoted Mo₆S₈ Clusters: A Platform for Probing Ensemble Effects on the Selective Conversion of CO₂ and CO to Methanol." *Materials Horizons* **2020**, 7, 193-202 (**Featured in "International Year of the Periodic Table: Single Atoms as Active**

Catalysts” Themed Issue).

6. **Joseph T. Perryman**; Forrest P. Hyler; Jessica C. Ortiz-Rodríguez, Apurva Mehta, Ambarish R. Kulkarni; Jesús M. Velázquez. “X-ray Absorption Spectroscopy Study of the Electronic Structure and Local Coordination of 1st Row Transition Metal-Promoted Chevrel-Phase Sulfides.” *Journal of Coordination Chemistry* **2019**, *72*, 1322-1335 (**Featured in Emerging Leader in Coordination Chemistry Special Issue**).

Publications in Progress

1. **Joseph T. Perryman**; Jesús M. Velázquez. “Advancing the Design and Energy-Conversion Applications of Pseudo-Molecular and Dimensionally Controlled Metal Chalcogenides.” (Submitted, Pending Minor Revision **2021**)
2. Jessica C. Ortíz Rodríguez; **Joseph T. Perryman**; Nicholas R. Stingstock; Charles B. Musgrave; Jesús M. Velázquez. “High-Efficiency CO₂ Electroreduction through Theory-Guided p-Band Modulation and Active-Site Ensemble Design for Binary and Ternary Metal Sulfides.” (In Preparation **2021**)
3. **Joseph T. Perryman**; Pralav P. Shetty; Matthew McDowell, Jesús M. Velázquez. “Elucidating Mo-Mo Dislocation Mechanisms in Anisotropic Molybdenum Sulfides via In-Situ TEM.” (In Preparation **2021**)
4. Jessica C. Ortiz-Rodríguez; Nicholas R. Singstock; **Joseph T. Perryman**; Charles B. Musgrave; Jesús M. Velázquez. “Machine Learning Extraction of Stable Hydrogen Evolving Compositions from Expansive Chalcogenide Composition Spaces.” (In Preparation **2021**)

*—Shared First-Author

Presentations and Posters

1. Jessica C. Ortiz-Rodríguez, **Joseph T. Perryman**, Jesús M. Velázquez. Stabilizing Proton Adsorption in Mo₆X₈ (X=S, Se, Te): Effect of chalcogen composition and morphology. Poster presented at the American Chemical Society Conference, Virtual Conference, April **2020**
2. Jessica C. Ortiz-Rodríguez, **Joseph T. Perryman**, Nicholas R. Singstock, Charles B. Musgrave and Jesús M. Velázquez. “Evaluating the Effect of Chalcogen Composition on Proton Stabilization in Chevrel-Phase Chalcogenides.” Poster presented at the Society for Advancement of Chicanos/Hispanics and Native Americans in Science, Virtual Conference, October **2020**
3. Jessica C. Ortiz-Rodríguez, **Joseph T. Perryman**, Nicholas R. Singstock, Charles B. Musgrave, Jesús M. Velázquez. “Stabilizing Hydrogen Adsorption through Theory-Guided Chalcogen Substitution in Mo₆X₈ (X=S, Se, Te) Electrocatalysts.” Poster presented at the 1st annual LatinX Chemistry Conference, Virtual Conference, **2020**
4. **Joseph T. Perryman**, Nicholas R. Singstock, Forrest P. Hyler, Charles B. Musgrave, Aaron M. Holder, Jesús M. Velázquez. “Tuning Electronic Structure and Local Coordination in M_xMo₆X₈ Frameworks: Toward the Electrochemical Reduction of CO₂ and CO to Fuels.” Poster presented at the 2019 North American Solid-State Chemistry Conference (NASSCC), Golden, CO **2019**
5. **Joseph T. Perryman**, Jessica Ortiz-Rodríguez, Ambarish R. Kulkarni, Christopher J. Patridge, Jesús M. Velázquez. “Chevrel-Phase Mo₆S₈—A Platform for Probing Ensemble Effects on Selective Conversion of CO₂ and CO to Methanol Over Metal-Promoted Sulfides.” Poster presented at the 2019 Spring MRS Meeting; Phoenix, AZ **2019**
6. **Joseph T. Perryman**, Andy Lam, Kristina Lilova, Ambarish R. Kulkarni, Christopher J. Patridge, Alexandra Navrotsky, Jesús M. Velázquez. “Probing Ensemble Effects on the Selective Conversion of CO₂ and CO to Methanol Over Metal-Promoted Chevrel-Phase Sulfides.” Invited Speaker at the 257th Conference of the American Chemical Society; Orlando, FL **2019**
7. Sarah Jones, **Joseph T. Perryman**, Jesús M. Velázquez. “Facile Synthesis of Chevrel-Phase Molybdenum Selenides with Applications in Energy Conversion and Storage.” Poster presented at the 257th conference of the American Chemical Society; Orlando, FL **2019 (Presentation by REU Student Mentee)**
8. Sarah Jones, **Joseph T. Perryman**, Jesús M. Velázquez. “Facile Synthesis of Chevrel-Phase Molybdenum Selenides with Applications in Energy Conversion and Storage.” Poster presented at the western regional meeting of the American Chemical Society; Pasadena, CA **2018 (Presentation by REU Student Mentee)**
9. Jessica C. Ortiz-Rodríguez, **Joseph T. Perryman**, Jesús M. Velázquez. “Synthesis of Chevrel Phase Sulfides for the Electrochemical Reduction of CO₂ to Liquid Fuels”. Poster presented at Society for Advancement of Chicanos/Hispanics and Native Americans in Science (SACNAS) conference; Salt Lake City, Utah **2017**

(Presentation by REU Student Mentee)

10. **Joseph T. Perryman**, Elizabeth J. O. Atkinson. "Physical Characterization of Organically Modified Polyoxometalates through Langmuir-Blodgett Deposition and Fluorescence Microscopy." Poster presented at the 251st Conference of the American Chemical Society; San Diego, CA **2016**
11. **Joseph T. Perryman**, Elizabeth J. O. Atkinson. "Physical Characterization of Organically Modified Polyoxometalates through Langmuir-Blodgett Deposition and Fluorescence Microscopy." Poster presented at the 24th Murdock College Science Research Conference; Vancouver, WA **2015**
12. **Joseph T. Perryman**, Elizabeth J. O. Atkinson, Robert C. Chambers. "Investigating a Hybrid Organosilyl Class of Dawson-Wells Polyoxometalates Through Langmuir-Blodgett." Poster presented at the 249th Conference of the American Chemical Society; Denver, CO **2015**
13. **Joseph T. Perryman**, Elizabeth J. O. Atkinson, Robert C. Chambers. "Investigating a Hybrid Organosilyl Class of Dawson-Wells Polyoxometalates Through Langmuir-Blodgett." Poster presented at the 23rd Murdock College Science Research Conference; Vancouver, WA **2014**

References

- Prof. Jesús M. Velázquez** **2016–Present**
Assistant Professor of Chemistry at the University of California, Davis
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- Prof. Charles B. Musgrave** **2018–Present**
Robert H. Davis Professor of Chemical and Biological Engineering at the University of Colorado at Boulder
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- Prof. Susan M. Kauzlarich** **2018–Present**
Distinguished Professor of Chemistry at the University of California, Davis
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- Prof. Ambarish R. Kulkarni** **2017–Present**
Assistant Professor of Chemical Engineering at the University of California, Davis
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