

Peisen Qian



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Education

○ Graduate: University of Illinois at Urbana-Champaign (UIUC)

Ph. D. program in Chemistry, 2022-present.

Tentative thesis: Quantitative Scanning Electrochemical Microscopy for Probing Kinetics and Detecting Intermediates in Proton-Coupled Electron Transfer Reactions.

Advisor: *Prof. Joaquín Rodríguez-López, Prof. Josh Vura-Weis*

○ Undergraduate: University of Science and Technology of China (USTC)

Bachelor in Science, Physical Chemistry, School of the Gifted Young (SGY), 2018-2022.

Advisor: *Prof. Shangfeng Yang*, Thesis: Understanding the Degradation Mechanisms of Organic-Inorganic Hybrid Perovskites and Approaches to Improve Their Stability.

Honors & Recognitions

Graduate: UIUC

2025 Drickamer Fellowship

2024 John and Margaret Witt Fellowship

2024 School of Chemical Science (SCS) Graduate Student Teaching Award

2024 St. Elmo Brady Symposium Poster Competition First Place

2023 Park-Klemperer IMAC Best Poster Award

2023 Kenneth L. Rinehart Fellowship

Undergraduate: USTC

2020, 2021 The School of the Gifted Young Class of 87 Innovation Scholarship

2019, 2020, 2021 Excellent Student Scholarship – Bronze, Silver, and Gold in the School of the Gifted Young

2018, 2019 Annual Scholarship for Sci-Tech Elite Class Students

Publications

Published (* denotes for first or co-first author):

7. Muñoz, M.; Chen, M. S.; de Araujo Lima e Souza, G.; Simunovic, T.; Khokhar, V.; **Qian, P.**; Wainright, J.; Savinell, R.; Parnell, A.; Parnell, S.; Kilbride, R. C.; Zawodzinski, T. A.; Dadmun, M.; Greenbaum, S. G.; Rodríguez-López, J.; Tuckerman, M.; Gurkan, B. Structured Electrolytes Facilitate Grothuss-Type Transport for Enhanced Proton-Coupled Electron Transfer Reactions. *Proceedings of the National Academy of Sciences* **2026**, 123 (1). <https://doi.org/10.1073/pnas.2530367122>.

6. **Qian, P.***; Cao, G.; Muñoz, M.; Vura-Weis, J.; Gurkan, B. E.; Peng, Z.; Rodríguez-López, J. Scanning Electrochemical Microscopy for Kinetic Investigations in Viscous Deep Eutectic Solvents: Identifying Practical Approach Curves and Deviations from Electron Transfer Models. *Analytical Chemistry* **2025**, 97 (30), 16239–16249. <https://doi.org/10.1021/acs.analchem.5c01310>.

5. Xu, Z.*; Saiev, S.*; **Qian, P.***; Nabei, Y.*; Wang, Z.; Rinehart, J. M.; Österholm, A. M.; Jones, A. L.; Lee, J.-H.; Hwang, C.; Wang, S.; Sun, R.; Shin, D.; Jeon, S.; Elangovan, K. E.; Vura-Weis, J.; Coropceanu, V.; Rodríguez-López, J.; Reynolds, J. R.; Sun, D.; Brédas, J.-L.; Diao, Y. Supramolecular Chirality Largely Modulates Chemical Doping of Conjugated Polymers. *Nature Communications* **2025**, 16 (1). <https://doi.org/10.1038/s41467-025-62915-3>.

4. Putnam, S. T.; Santiago-Carboney, A.; **Qian, P.**; Rodríguez-López, J. Scanning Electrochemical Microscopy: An Evolving Toolbox for Revealing the Chemistry within Electrochemical Processes. *Analytical Chemistry* **2025**, 97 (15). <https://doi.org/10.1021/acs.analchem.4c06996>.

3. Asserghine, A.; Baby, A.; Putnam, S. T.; **Qian, P.**; Gao, E.; Zhao, H.; Rodríguez-López, J. In Situ Detection of Reactive Oxygen Species Spontaneously Generated on Lead Acid Battery Anodes: A Pathway for Degradation and Self-Discharge at Open Circuit. *Chemical Science* **2023**, 14 (43), 12292–12298. <https://doi.org/10.1039/D3SC04736A>.

2. Shang, Y.; Wang, P.; Jia, L.; Li, X.; Lian, W.; **Qian, P.**; Chen, M.; Chen, T.; Lu, Y.; Yang, S. Synchronous Defect Passivation of All-Inorganic Perovskite Solar Cells Enabled by Fullerene Interlayer. *Nano Research Energy* **2023**, 2, e9120073. <https://doi.org/10.26599/nre.2023.9120073>.

1. Hu, W.; Wen, Z.; Xin, Y.; **Qian, P.**; Lian, W.; Li, X.; Shang, Y.; Wu, X.; Chen, T.; Lu, Y.; Wang, M.; Yang, S. In Situ Surface Fluorination of TiO₂ Nanocrystals Reinforces Interface Binding of Perovskite Layer for Highly Efficient Solar Cells with Dramatically Enhanced Ultraviolet-Light Stability. *Advanced Science* **2021**, *8* (10). <https://doi.org/10.1002/advs.202004662>.

Manuscript in preparation:

4. Prasad A.; Das, S.; **Qian, P.**; Olvera-Vargas, H.; and Rodríguez-López, J. Scanning Electrochemical Microscopy Detection of Anodically Generated Peroxymonocarbonate (PMC) in Bicarbonate Media: Implications for PMC-Mediated Paired Electrolysis Applied to Pollutant Degradation.

3. **Qian, P.***; Rodríguez-López, J.; Vura-Weis, J. An Affordable Shifted-Excitation Raman Difference Spectroscopy (SERDS) Setup: Construction, Noise Analysis, and Detection Limits.

2. **Qian, P.***, Rodríguez-López, J. Direct Detection of Intermediates in Proton-Coupled Electron Transfer of TEMPO Derivatives Using Scanning Electrochemical Microscopy.

1. **Qian, P.***; Gupta, S.; Martin, K.; Lin, Z.; Rasmussen, B.; Vura-Weis, J.; Warburton, R.; Rodríguez-López, J. Scanning Electrochemical Microscopy Study of Proton-Coupled Electron Transfer Processes in Aqueous and Concentrated Hydrogen-Bonded Electrolytes: Reorganization Energies and Kinetic Correlations with Medium Acidity.

Conference & Symposium Presentations

Oral presentations:

2. Quantitative Scanning Electrochemical Microscopy for Proton-Coupled Electron Transfer Kinetics Investigation in Ionic Liquids. **Peisen Qian**, Saransh Gupta, Ge Cao, Zhen Peng, Robert Warburton, and Joaquín Rodríguez-López. 248th ECS Meeting, Hilton Chicago, Chicago, IL, Oct., **2025**.

1. Quantitative Scanning Electrochemical Microscopy (SECM) for Proton-Coupled Electron Transfer (PCET) Kinetics Investigation. **Peisen Qian**, Josh Vura-Weis, and Joaquín Rodríguez-López. Changwoo Park – Walter Klemperer Inorganic/Materials Conference, Allerton Park, Monticello, IL, Sep., **2025**.

Poster presentations:

6. Electron Transfer Kinetics and Dynamics in Deep Eutectic Solvents with Scanning Electrochemical Microscopy and Surface-enhanced Raman Scattering. **Peisen Qian**, Josh Vura-Weis, and Joaquín Rodríguez-López. Changwoo Park – Walter Klemperer Inorganic/Materials Conference, Allerton Park, Monticello, IL, Oct., **2024**.

5. Electron Transfer Kinetics in Concentrated Hydrogen Bonded Electrolytes for Energy Storage. **Peisen Qian**, Ge Cao, Zhuang Xu, Zhen Peng, Ying Diao, Josh Vura-Weis, and Joaquín Rodríguez-López. Turkey Run Analytical Chemistry Conference, Turkey Run State Park, Marshall, IN, Sep., **2024**.

4. Unravel Electrochemical Kinetics in Redox Flow Battery Electrolytes. **Peisen Qian**, Josh Vura-Weis, and Joaquín Rodríguez-López. St. Elmo Brady Symposium, University of Illinois Urbana – Champaign, Champaign, IL, Feb., **2024**.

3. Electron Transfer Kinetics and Dynamics in Deep Eutectic Solvents with Scanning Electrochemical Microscopy and Surface-enhanced Raman Scattering. **Peisen Qian**, Josh Vura-Weis, and Joaquín Rodríguez-López. Turkey Run Analytical Chemistry Conference, Turkey Run State Park, Marshall, IN, Sep., **2023**.

2. Electron Transfer Kinetics and Dynamics in Deep Eutectic Solvents with Scanning Electrochemical Microscopy and Surface-enhanced Raman Scattering. **Peisen Qian**, Ge Cao, Zhen Peng, and Joaquín Rodríguez-López. 11th SECM Workshop, McGill University, Montreal, Canada, September., **2023**.

1. Electron Transfer Kinetics and Dynamics in Deep Eutectic Solvents with Scanning Electrochemical Microscopy and Surface-enhanced Raman Scattering. **Peisen Qian**, Ge Cao, Zhen Peng, and Joaquín Rodríguez-López. Changwoo Park – Walter Klemperer Inorganic/Materials Conference, Allerton Park, Monticello, IL, Sep., **2023**.

Research Experience

➤ **Lab of Advanced Electroanalysis for Energy Materials | University of Illinois at Urbana-Champaign (UIUC)**

Advised by Prof. Joaquín Rodríguez-López, Department of Chemistry

1. **Interfacial charge transfer kinetics in aqueous and concentrated hydrogen-bonded electrolytes, collaboration with Prof. Rob Warburton's group, 2023-present. Manuscript in preparation (1).**

- Validated reduction product protonation states of 2,7-AQDS at different pH using Pourbaix analysis and spectroscopic methods.

- Extracted reorganization energy (λ), transfer coefficient (α), and standard rate constant (k^0) from k -plots with Butler-Volmer and Marcus-Hush-Chidsey formalisms.
 - Demonstrated the acidity dependence of λ and k^0 in aqueous and concentrated hydrogen-bonded electrolytes.
2. **SECM approach curves in solvents with varying viscosity and a magic point, collaboration with Prof. Zhen Peng's group, 2023-2025. Publication (6).**
 - Characterized and simulated SECM approach curves as a function of solvent viscosity and approach velocity.
 - Identified a “magic point” in positive feedback approach curves for precise tip positioning.
 - Developed a SECM-based method for measuring heterogeneous electron transfer kinetics (k -plot).
 3. **SECM-based Tafel analysis of conjugated polymer films, collaboration with Prof. Ying Diao's group, 2024. Publication (5).**
 - Demonstrated that the standard rate constant and charge transfer coefficient differ between films.
 - Provided supportive evidence for the correlation between standard rate constant (k_0) and the film chirality.
 4. **EPR simulation of radical species, Publication (3), 2022.**
 - Simulated splitting constant and g factor for $\cdot\text{OH}$ in water.
 - Provided supportive evidence that radicals are key species in lead-acid battery degradation.
- **Lab of Femtosecond Transient Absorption Spectroscopy | University of Illinois at Urbana-Champaign (UIUC)**

Advised by Prof. Josh Vura-Weis, Department of Chemistry

5. **Shifted excitation Raman difference spectroscopy instrument construction, 2025. Manuscript in preparation (1) and (3).**
 - Obtained two excitation beams at 663 and 664nm (FWHM < 0.25 nm) with a Walmart laser pointer.
 - Developed experimental methods and processing procedure that minimize spectra artifacts.
 - Reconstruct the in situ Raman spectrum of a fluorescent and electrochemically redox-active molecule, 2,7-AQDS, at oxidation and reduction potentials.
6. **Density functional theory (DFT) calculation of electrochemical reduction formal potential. Manuscript in preparation (4).**
 - Calculated free energies of carbonate species clustered with water molecules.
 - Obtained formal potentials for $\text{HCO}_4^{\cdot-} + e^- \rightarrow \text{CO}_3^{\cdot-} + \text{OH}^-$ reaction.

Skills

Electrochemistry: Scanning electrochemical microscopy (SECM), CV, RDE, EIS, Generation-collection, ultramicroelectrode fabrication, among others.

Spectroscopy: Optical transient absorption (OTA), Raman, IR, UV-vis, among others.

Programming and computation: Python, C, Gaussian, Easyspin, MATLAB, Mathematica, LabVIEW, COMSOL Multiphysics, DigiElch.

Academic Internship

2. In & Ex situ Nano-FTIR probes into interactions between ligands and nanoparticles, **2021**. Lawrence Berkeley National Laboratory (LBNL) & University of California, Berkeley (UCB). Advised by **Prof. Miquel Salmeron**, Department of Materials Science and Engineering.
1. Geometry optimization of pnictogen-containing supramolecules, **2020**. McMaster University. Advised by **Prof. Ignacio Vargas-Baca**, Department of Chemistry & Chemical Biology.

Teaching Experience

Graduate: UIUC

2023, 2024 Teaching Assistant for **Prof. Nick Jackson**, Chem 442, **Physical Chemistry I**

2023 Teaching Assistant for **Prof. Nancy Makri**, Chem 540, **Quantum Mechanics**

Undergraduate: USTC

2020 Teaching Assistant for **Prof. Yuen Wu**, **General Chemistry**

Community Service & Extracurricular Activities

Graduate: UIUC

Since 2022 President, International Chemists Association (ICA)
Since 2022 UIUC Go Society Go player
2024 Beckman Open House Volunteer
2023-2025 Electrochemical Bootcamp Student Instructor
2023-2025 ICA Tax Return Workshop Organizer
2022-2025 ICA Student Welcome Luncheon Organizer
2022-2025 ICA International Student Forum Organizer

Undergraduate: USTC

2021 President, USTC Student Badminton Society
2018-2022 Principal flute player, USTC Philharmonic
2018-2022 Go player, USTC Go Society