Peisen Qian

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Education

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

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

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: Research on the degradation mechanism of organic-inorganic hybrid perovskite and strategies to improve its stability

Honors & Recognitions

At UIUC:

2025 Drickamer Fellowship
2024 John and Margaret Witt Fellowship
2024 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

At USTC:

2021 The School of the Gifted Young Class of 87 Innovation Scholarship
2021 Excellent Student Scholarship – Gold, in the School of the Gifted Young
2020 The School of the Gifted Young Class of 87 Innovation Scholarship
2020 Excellent Student Scholarship – Bronze, in the School of the Gifted Young
2019 Annual Scholarship for Sci-Tech Elite Class Students
2019 Excellent Student Scholarship – Silver, in the School of the Gifted Young
2018 Annual Scholarship for Sci-Tech Elite Class Students

Conference & Symposium Presentations

1. Quantitative Scanning Electrochemical Microscopy for Proton-Coupled Electron Transfer Kinetics Investigation in Ionic Liquids. **248th ECS Meeting, Hilton Chicago, Chicago, IL,** Oct 12-16, 2025.
2. Quantitative Scanning Electrochemical Microscopy (SECM) for Proton-Coupled Electron Transfer (PCET) Kinetics Investigation. **Changwoo Park – Walter Klemperer Inorganic/Materials Conference, Allerton Park, Monticello, IL,** Sep 20, 2025.
3. Electron Transfer Kinetics and Dynamics in Deep Eutectic Solvents with Scanning Electrochemical Microscopy and Surface-enhanced Raman Scattering. **Changwoo Park – Walter Klemperer Inorganic/Materials Conference, Allerton Park, Monticello, IL,** Oct 5, 2024.
4. Electron Transfer Kinetics in Concentrated Hydrogen Bonded Electrolytes for Energy Storage. **Turkey Run Analytical Chemistry Conference, Turkey Run State Park, Marshall, IN,** September 27, 2024.
5. Unravel Electrochemical Kinetics in Redox Flow Battery Electrolytes. **St. Elmo Brady Symposium, University of Illinois Urbana – Champaign, Champaign, IL,** February 10, 2024.
6. Electron Transfer Kinetics and Dynamics in Deep Eutectic Solvents with Scanning Electrochemical Microscopy and Surface-enhanced Raman Scattering. **Turkey Run Analytical Chemistry Conference, Turkey Run State Park, Marshall, IN,** September 29, 2023.
7. Electron Transfer Kinetics and Dynamics in Deep Eutectic Solvents with Scanning Electrochemical Microscopy and Surface-enhanced Raman Scattering. **11th SECM Workshop, McGill University, Montreal, Canada,** September 25, 2023.
8. Electron Transfer Kinetics and Dynamics in Deep Eutectic Solvents with Scanning Electrochemical Microscopy and Surface-enhanced Raman Scattering. **Changwoo Park – Walter Klemperer Inorganic/Materials Conference, Allerton Park, Monticello, IL,** September 16, 2023.

Publications

** = equal contribution*

(1) **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.

(2) **Qian, P.;** Gupta, S.; Martin, K.; Lin, Z.; Rasmussen, B.; Warburton, R., Vura-Weis, J.; Rodríguez-López, J. Scanning Electrochemical Microscopy for Proton-Coupled Electron Transfer Investigation: Reorganization Energy and Kinetic Correlation with Medium Acidity (manuscript in preparation)

(3) 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. 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.**; Joaquín Rodríguez-López. 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.

(5) 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 Grotthuss-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) 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.

(7) 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.

(8) 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 TiO_2 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.

(9) **Qian, P.***; Xia, T.*; Hu, Z.*; Wang, Z; Yang, S.; et al. Insights into Hybrid Perovskite Degradation: Photoionization Mass Spectrometry Analysis (manuscript in preparation).

Research Experience

At UIUC:

➢ **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 processes in deep eutectic solvents (DESs), 2022-present

- Developed a new SECM-based method for accurate heterogeneous kinetical constant measurement.
- Derived the reorganization energy of quinone oxidation reaction with Marcus-Hush-Chidsey equation.
- Proved the reorganization energy and quinone oxidation mechanisms are dependent on proton concentration.

2. Lattice Boltzmann simulation of approach curves, collaboration with Prof. Zhen Peng's group, 2023-2025.

- Applied the lattice Boltzmann method to simulate negative and positive feedback approach curves in viscous media.
- Derived explicit equations for current as a function of substrate-tip distance under different Reynold and Peclet numbers.
- Applied deep learning model to give numerical simulations of approach curves.

3. **SECM-based Tafel analysis of conjugated polymer films, collaboration with Prof. Ying Diao's group, 2024**
- Demonstrated that the standard rate constant and charge transfer coefficient differ between films.
- Provided supportive evidence that the kinetic behavior depends on the chiral-induced spin selectivity (CISS) effect.

➢ **Lab of Femtosecond Transient Absorption Spectroscopy | University of Illinois at Urbana-Champaign (UIUC)**

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

1. **Transient absorption spectroscopy of quinones and metal complexes**
- Provided transient absorption spectra at various time delays for different spectrally active molecules.
- Measured rotational correlation time of different molecules with optical transient absorption spectroscopy.
- Demonstrated that 2,7-AQDS (a quinone) exhibits longer rotational correlation times in more viscous media.

2. **DFT calculation on Ru complexes and amine-CO_2 interactions, collaboration with Prof. Joaquín Rodríguez-López's group, 2022-present**
- Simulated UV-vis and IR spectrum for different molecules.
- Provided electronic transition and orbital information of Ru complexes.
- Calculated intrinsic reaction coordinates for different amine-CO_2 molecules.

3. **EPR simulation of radical species, collaboration with Prof. Joaquín Rodríguez-López's group, 2022**
- Simulated splitting constant and g factor for ·OH in water.
- Provided supportive evidence for radicals as critical species in the degradation of lead-acid batteries.

Before UIUC:

➢ **Lab of Properties of Nanometer Chemicals on Surfaces and Interfaces | Lawrence Berkeley National Laboratory (LBNL) & University of California, Berkeley (UCB)**

Advised by ***Prof. Miquel Salmeron***, *Department of Materials Science and Engineering*

In & Ex situ Nano-FTIR probes into interactions between ligands and nanoparticles, 2021
- Fabricated and examined graphene monolayer with atomic force microscopy.
- Probed dynamic interactions between ligand (Tetradecylphosphonic acid) and Ag nanoparticles with in-situ & ex-situ nanoscale Fourier transform infrared spectroscopy under gradient cathode potential (*Advanced Light Source, CA, US*).
- Validated the dynamical formation of nanoparticles / ordered-ligand interlayer that coordinate sites exhibit excellent selectivity and activity for CO_2 electroreduction.

➢ **Lab of Supramolecular Main-Group Chemistry | McMaster University**

Advised by ***Prof. Ignacio Vargas-Baca***, *Department of Chemistry & Chemical Biology*

Geometry optimization of interactions in pnictogen-containing supramolecules, 2020
- Optimized geometries and thermodynamic parameters for pnictogen-containing ligands.
- Probed patterns of dimerization for different periodically analogical monomers.
- Predicted the main product for dimerization of monomers with different main group elements.

➢ **Lab of Perovskites & Fullerene Functional Materials | USTC**

Advised by ***Prof. Shangfeng Yang***, *Department of Materials Science & Engineering*

1. **Degradation mechanisms & pathways of perovskites (manuscript in preparation), 2021-2022**
- Validated thermal decomposition products of organic-inorganic hybrid perovskites and their precursors via synchrotron radiation vacuum ultraviolet-photoionization mass spectroscopy (*National Synchrotron Radiation Lab, Hefei, China*)
- Analyzed photocatalytic decomposition kinetics of both as-prepared perovskites and their precursors in toluene.
- Proved the participation of certain free radicals (·CH3, $\cdot O_2^-$) during perovskite $MAPbI_3$ degradation via EPR.

2. **Fluorination of electron transfer layer in organic-inorganic hybrid perovskite solar cells, 2019-2020**
- Optimized the synthesis conditions of F-doped TiO_2 nanocrystals as electron transport layers in perovskite solar cells.
- Proved Pb-F bonds and hydrogen bonds via X-ray photoelectron spectroscopy and nuclear magnetic resonance.
- Evaluated the photocatalytic activity of F-doped TiO_2 under irradiation of a solar simulator to explain the improvements in UV-light stability of the perovskite solar cells.

Outreach & Extracurricular Activities

At UIUC:

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

At USTC:

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

Teaching Experience

At 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

At USTC:

2020	Teaching Assistant for Prof. Yuen Wu, General Chemistry