

Peisen Qian

Email: peiseng2@illinois.edu | Phone: +1-447-902-1075 | Address: 600 S Goodwin Ave, Urbana, IL 61801

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:

- 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. New Techniques to Unravel Electrochemical Kinetics and Dynamics in Redox Flow Battery Electrolytes. **BEES2 All-Hands Meeting, Case Western Reserve University, Cleveland, OH**, March 14, 2024.
2. Unravel Electrochemical Kinetics in Redox Flow Battery Electrolytes. **St. Elmo Brady Symposium, University of Illinois Urbana – Champaign, Champaign, IL**, February 10, 2024.
3. 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.
4. 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.
5. 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

- (1) **Qian, P.**; Cao, G., Munoz, M.; Gurkan, B., Peng Z.; Rodríguez-López J. Analytical Expressions for Quantitative Scanning Electrochemical Microscopy in Viscous Media (manuscript in preparation).
- (2) **Qian, P.**; Xia, T.; Hu, Z.; Wang, Z; Yang, S.; et al. Insights into Hybrid Perovskite Degradation: Photoionization Mass Spectrometry Analysis (manuscript in preparation).
- (3) Xu Z., Saiev S.; Nabei Y.; **Qian P.**; Rodríguez-López, J.; Reynolds J.; Sun D.; Brédas, J.; Diao, Y.; et al. Supramolecular Chirality Largely Modulates Chemical Doping of Achiral Conjugated Polymers (manuscript in preparation).
- (4) Asserghine, A.; Baby, A.; T. Putnam, S.; **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>.

- (5) 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>.
- (6) 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>.

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-present

- 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-CO₂ 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-CO₂ 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 CO₂ 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 ($\cdot\text{CH}_3$, $\cdot\text{O}_2$) during perovskite MAPbI₃ 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 TiO₂ 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 TiO₂ 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	Chairman, 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, 2023	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
------	---