Curriculum Vitae

Saptarshi (Rishi) Paul

rishi7@uchicago.edu | +1 7657673232|
www.linkedin.com/in/paulsap28 Google Scholar Link

Current Position:

University of Chicago
Postdoc at Supratik Guha Lab, Pritzker School of Molecular Engineering (Jan 2026- Present)

Current Work:

Building Autonomous Electrodeposition Setup for Microelectronics

- Specialized in copper (Cu) electrodeposition for semiconductor interconnect applications in microelectronic systems.
- Performed electrical and structural characterization using four-point probe measurements, surface reflectivity analysis, SEM, XRD, and related techniques.
- Developed robotics-integrated workflows and Python-based AI automation to streamline and optimize the entire deposition and characterization process.

Education:

Purdue University **(**Aug 2022- Jan 2026)
Doctor of Philosophy – Chemistry (CGPA: 4/4)

Indian Institute of Technology Kanpur (IIT Kanpur) (2019- 2021)
Master of Science – Chemistry (CGPA: 9.1/10)

St. Xavier's College, Kolkata (2015-2018)
Bachelor of Science – Chemistry (CGPA:7.56/10)

Research Experience:

PhD Candidate, Prof. Jeffrey Dick (Aug 2022- Present)
Chemistry Department, Purdue University, IN, USA

- Study of droplet mediated deposition of nanoparticles/ alloys and their subsequent application in Hydrogen Evolution Reaction (HER) catalysis
- Understanding the electrodeposition mechanism in Aqueous Zinc Metal Batteries (AZMBs)
- Innovating a new electrodeposition method for generating nanoparticles

Master's Research, Prof. Thiruvancheril Gopakumar (Jan 2021 - Dec 2021)
Chemistry Department, IIT Kanpur, India

- Analyzing the Switching Behavior of Azobenzene Molecules under light and heat.
- Used Scanning Tunneling Microscopy (STM) and Atomic Force Microscopy (AFM) to probe the conformational change in the molecules

Undergraduate Research, Prof. Rahul Sharma (Aug 2017 - Apr 2018)
Chemistry Department, St. Xavier's College, India

- Finding most stable Lennard Jones Structure using Artificial Bee Colony (ABC) Algorithm.
- Using the exploration and exploitation mechanism of the ABC Algorithm simultaneously with Random Mutation Hill Climbing (RMHC) to find the coordinates for the most stable LJ-potential for a given number of atoms.

1st Author Publications:

1. **Paul, S**.*, Nguyen, J.H*, Harrigan, M.L., Rana, A., Berbille, A. and Dick, J.E. Small changes, big gains: standardizing non-electrode coin cell components in aqueous zinc battery research. **EES Batteries**, 2025, 1, 813-823 (Outside Front Cover of Journal) (Top 10%- Hot Article)
2. Rana, A.*; **Paul, S***.; Bhadouria, A.; Nguyen, J.H.; Faisal, Md.; Tackett, B.M.; Dick, J.E. Beyond the Artifact: In-Situ Quantification of True HER Kinetics During Zn Electrodeposition in Aqueous Zinc Metal Batteries. **Advance Energy Materials**.2025. e03155 (*=equal contribution)
3. *Rana, A.; **Paul, S**.*; Bhadouria, A.; Nguyen, J.H**.;** Li, C.; Das, A.; Tackett, B.M.; Dick, J.E.; Interfacial pH Gradients Explain High Coulombic Efficiency at High Current Densities for Zinc Metal Batteries. (accepted, **Joule**) (*=equal contribution)
4. **Paul, S.$^{+}$;** Reyes-Morales, J.$^{+}$; Roy, K.; Dick, J.E. Anodic Electrodeposition of IrOx using Aqueous Nanodroplets. **ACS Nanoscience Au**. 2024 *4* (3), 216-222
5. Reyes-Morales, J^{+}.; **Paul, S**$^{\cdot+}$; Vullo, M^{+}.; Edwards, M.; Dick, J.E. Room Temperature Electrochemical-Shock Synthesis of Solid-Solution Medium-Entropy Alloy Nanoparticles for Hydrogen Evolution. **Langmuir** 2024,40,24272−24280. (+=equal)
6. **Paul, S**.; Koons, J.; Roy, K.; Dick, J.E. Potential Dictated Analysis of E the Microstructure of Single Nanoparticles. **Electroanalysis**. 2024. 37 (4), e12043.
7. **Paul, S.**; Berbille, A.; Faisal, A.; Nguyen, J.; Rana, A.; Shang, Z.; Seo, D.; Nam, K.; Dick, J. E. Ambient, bias-free nanoparticle synthesis via droplet-confined galvanic chemistry. (under review, **Small**)

Co-Author Publications:

1. Koons, J. F., **Paul, S.**, & Dick, J. E. (2025). Oxygen Reduction Allows Morphology-Tunable Copper Nanoparticle Electrodeposition from Aqueous Nanodroplets. ***Langmuir***, *41*(8), 5524-5533.
2. Rana, A., Faisal, M. A., Roy, K., Nguyen, J. H., **Paul, S.**, & Dick, J. E. (2025). How the Kinetic Balance Between Charge-Transfer and Mass-Transfer Influences Zinc Anode Stability: An Ultramicroelectrode Study. ***Small Methods***, *9*(3), 2401021.
3. Koons, J. F.; Rana, A.; Faisal, M. A.; Nguyen, J. H.; **Paul, S**.; Lawrence, J. H.; Dick, J. E. Resting but not idle: unveiling the mechanistic origin of resting losses for zinc anodes. ***Energy Environ. Sci.*** **2025**, *18* (23), 10180–10194**.**
4. Rana, A.; Faisal, M. A.; Nguyen, J. H.; **Paul, S.**; Koons, J. F.; Lawrence, J. H.; Dick, J. E. An electroanalytical perspective on the competitive interplay between zinc deposition and hydrogen evolution in aqueous zinc metal batteries. ***Adv. Energy Mater.*** 2025, e03630.
5. Nguyen, J.; Rana, A.; Shiprath, K.; Bhagat, B. R.; **Paul, S.**; Chatterjee, S.; Dick, J. E. Amide additives enhance the understanding of kinetic reversibility in zinc anode stability using ultramicroelectrodes. ***Chem. Sci.*** 2025.
6. Li, T.; Faisal, M.; Rana, A.; Nguyen, J. H.; **Paul, S.**; Bhadouria, A.; Tackett, B. M.; Dick, J. E. Proton dynamics govern hydrogen evolution: mechanistic view of solvent isotope effects in zinc anodes. (in preparation)
7. Faisal, Md., Taizhe, L.; Rana, A., Nguyen, J.H., **Paul, S.,** Bhadouria. A., Tackett, B., & Dick, J.E. (2025) Slowing Down Zinc Electrodeposition Kinetics Can Maximize and Compromise Anode Stability: How Slow is Too Slow? (under revision, **Angewandte Chemie**)

Patents:

Bias-Free Template-Assisted Microdroplet Chemistry: A Green Route to Nanoparticle Synthesis at Ambient Conditions. **Paul,S.,** Berbille, A., & Dick, J.E. (under review)

Oral and Poster Presentations:

Oral Presentations*:*

1. "Probing Hydrogen Evolution at the Electrode–Electrolyte Interface: Analytical Innovations for Catalysis and Energy Storage", ACS Fall 2025, Wahington, DC.
2. "The Chemistry of Alloy Nanoparticles: From Fundamentals to Applications", April 2024, Birck Nanotechnology Symposium 2024, Purdue University, WL, IN
3. "Separating Electrodeposition from Electroprecipitation for Single Nanoparticles", August 2025, Turkey Run Midwest Conference.
4. "From Atoms to Energy: The Use of Electron Microscopy in Nanomaterials and Battery Research", March 2025, Purdue Electron Microscopy Open Day

Poster Presentations*:*

- "Analyzing the Role of HER in Aqueous Zinc Metal Batteries" (Best Poster Prize, Birck Annual Symposium 2025)
- "Controlling the Microstructure and Morphology of Single Nanoparticles" (Norte Dame Conference, November 2024)
- "Nanodroplet-Mediated Electrodeposition of IrOx nanoparticles" (Turkey Run, August 2024)
- "Best Electrodeposition Practices for Aqueous Zinc Metal Batteries" (Electrochemical Society Conference, ECS Chicago, Fall 2025)

Teaching and Mentoring Experience:

Purdue University Teaching Assistant:

- CHEM 115 – General Chemistry I Lab (Fall 2022)
  Held Recitations and lab sessions for undergraduate students
- CHEM 116- General Chemistry II Lab (Spring 2023)
  Held Recitations and lab sessions for undergraduate students
- CHEM 696- Analytical Chemistry (Fall 2025)
  Gave lectures to 1st year PhD students
- CHEM 696- Electrochemistry (Spring 2025)
  Gave lectures to PhD students working in electrochemistry research.

Mentoring:

- Undergrad Summer Exchange Student: Michael Vullo. Project: "Electrodeposition of Alloy Nanoparticles and Evaluating their Catalytic Performance." (Summer, 2023)
- Chemistry Graduate Student: John Fredrick Koons. Project: "Understanding Microstructure and Morphology of Single Nanoparticles." (Fall 2023-Spring 2024)
- Chemistry Undergrad Student: Michael Harrigan. Project: "Understanding the effect of HER during electrodeposition: From Nanoparticle Synthesis to Aqueous Zinc Metal Batteries." (Fall2024- Fall 2025).

Technical Skills:

- Packages (Chemistry): GIMP, ImageJ, WSxM, Accelrys Viewer and Origin.
- Languages: Java, Fortran, MATLAB and COMSOL.
- Electrochemical Tools: Potentiostat for various Electrochemical Characterization, Rotating Disc Electrode (RDE), Ultramicroelectrode fabrication and Battery Technologies (Coin Cell manufacture process and Battery Tester)
- Characterization Tools: SEM-EDX-FIB, TEM -STEM--HAADF **,**SAED, EELS, Cryo-EM, XRD, XPS, DLS, UV-Vis Spectrophotometer, Fabrication of Triboelectric Nanogenerator.

Awards and Achievements:

- All India Chemistry Entrance Exam (IIT- JAM 2019): Rank 72 out of 15731. (99.54% percentile)
- Best Poster Prize- Birck Annual Symposium 2025
- Invited Talk- Purdue Electron Microscopy Day 2025
- Guest Lecture- "Mass Transfer in Electrochemistry" (North Carolina State University, 2025)
- Front Outside Cover of Journal and Hot Article (Top 10%) Selection- EES Batteries https://doi.org/10.1039/D5EB00084J

Professional Service:

- Student Coordinator of Analytical Chemistry Student Seminars (Purdue, Fall 2025)
- Organizer of Professional Development Program for Purdue Chemistry Students (Purdue Graduate Student Advisory Board, 2023)
- Lead Volunteer of Faculty Speakers for Chemistry Honors Society (Phi Lambda Upsilon, Purdue, 2024-2025)

Community Service:

International Student Ambassador (Purdue University, 2023-2024)

- Organizer of multiple events for international students and parents. (ISS Purdue)
- Highlighted in Purdue magazine for service to the international community.

Global Partnerships and Programs Student Ambassador (Purdue University, 2024-2025)

- Official Campus tour guide to international politicians visiting Purdue.
- Coordinated multiple events for foreign faculty vising Purdue

Founder of Support Group for Students struggling during COVID (IIT Kanpur,2020-2021)

- Online Meetups to support students
- Organized Fresher for incoming Covid Batch via Zoom

Founder of Interdepartmental Discussion group (St. Xavier's College, 2015-2018)

- Weekly gatherings with students from multiple departments for exchange of ideas
- Building a 300+ community

Miscellaneous Work Experience:

- Teacher in a US Startup Company (Tutorang), 2021
- Doubt Solver and Textbook Writer in Chegg, 2019-2021
- Education Content Creator (Youtube- https://www.youtube.com/@saptarshipaul3130)