

# Nikhil R. Agrawal - Curriculum Vitae

Process Engineer

Deposition Product Group, Lam Research  
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## EDUCATION

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### Ph.D. in Chemical Engineering

August 2024

University of California, Berkeley, USA

Specialization area: Electrolysis, Electrolytes, Polyelectrolytes, Separation Processes, Mathematical Modeling

Thesis title: *Modified Gaussian Renormalized Fluctuation Theory for Electrolytes at Interfaces*

Advisor: Prof. Rui Wang

### B. Tech. and M. Tech (Dual Degree) in Chemical Engineering

July 2018

Indian Institute of Technology (IIT), Delhi, India

*Institute Silver Medal for highest GPA in the program*

Specialization area: Multiphase Reactors, Techno-economic analysis of processes, Mathematical Modeling

Master's thesis title: *Microscopic characterization of particle packings in packed bed reactors*

Master's thesis advisor: Prof. Shantanu Roy, Executive Director, IIT Delhi- Abu Dhabi

## WORK EXPERIENCE

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### Semiconductor Product Development & Strategic Customer Engagement

Sep'24 - Present

Process Engineer | Global Products Group, Lam Research, Oregon, USA

Point of contact on company's engagement with Taiwan based world's largest semiconductor manufacturing company on Lam's Striker Oxide DH product line. Responsible for:

- Coordinating and driving a multinational team of software, mechanical, electrical, and RF plasma engineers, together with Lam's Field Service Engineers in Taiwan, to ensure smooth project execution.
- Designing Lam's Strike Oxide DH architectures through the application of Techno-Economic Analysis and Life-Cycle Assessment, ensuring a balanced focus on cost-efficiency, process performance, and environmental sustainability.
- Leading the first successful production deployment of silicon oxide and silicon nitride film stack on Striker Oxide DH systems.
- R&D to develop new deposition processes for various thin film materials crucial for modern integrated circuits.

In general, alongwith senior leadership I engage with customers in key markets (USA, South Korea, China, Taiwan, and Singapore), aligning customer needs with Lam's business strategy for the Striker Oxide DH product line.

### Electrochemistry for energy storage, chemical manufacturing, and rare earths extraction Aug '18 - Aug '24

Ph.D. Candidate | Chemical Engineering, University of California, Berkeley, USA

Original research work to explain how highly concentrated salt solutions behave near charged surfaces, leading to 7 first author research publications and multiple conference presentations. Some applications of work are:

- lithium/sodium ion batteries, hydrogen fuel cells, electrolysis for hydrogen production
- rare earth mineral extraction and separation processes, ex: direct lithium extraction, molten salt electrolysis
- membrane separation processes for water desalination, waste water and chemical waste treatment

**Advanced ML and Bayesian Modeling for quantifying uncertainty in material models** Mar '24 - June '24  
**Semester Intern | Physics Division, Lawrence Livermore National Laboratory, USA**

Collaborated with a 10+ member multidisciplinary team to deploy Bayesian and deep-learning methods for quantifying predictive uncertainty in materials simulations, expanding my understanding of modern AI/ML technologies relevant across industries.

**Data Science, Cloud Computing, and Monte-Carlo simulations for complex systems** June '23 - Aug '23  
**Summer Intern | Center of Computational Biology, Flatiron Institute, New York, USA**

Conducted large-scale hybrid Monte-Carlo and Molecular dynamics simulations to model protein behavior during cell division, building capabilities in Monte-Carlo methods, cloud-based computation, and scientific data engineering.

**Reactor Catalyst-Packing optimization for efficiency gains in refining operations** Jan '17 - July '18  
**Master's Candidate | Department of Chemical Engineering, IIT Delhi, India**

Designed and validated a mathematical model describing catalyst-bed microstructure, providing insights that could improve packing-methods and led to 2 publications.

**Large scale computer simulations to optimize catalyst packing in packed bed reactors** May '17 - July '17  
**Visiting Researcher | Mentor: Prof. Dr. Thorsten Pöschel, University of Erlangen-Nuremberg, Germany**

Part of a multinational India-Germany research team to optimize catalyst-packing in packed-bed reactors for improved crude-oil refining efficiency, applied cloud computing and Monte Carlo simulations to evaluate and refine packing strategies.

**Design optimization to increase cooling efficiency in nuclear reactors** May '16 - July '16  
**Summer Intern | Porous Media Group, Institut de Mecanique des Fluides de Toulouse (IMFT), France**

Worked at one of the world's largest fluid mechanics institutes and developed a software tool to analyze experimental images, enabling faster optimization of reactor design.

**Design of solar-powered photocatalysts for conversion of CO<sub>2</sub> into commodity chemicals** May '15 - April '16  
**Undergraduate Researcher | Mentor: Prof. Suddhasatwa Basu, Chemical Engineering, IIT Delhi, India**

Photo-catalysis is the use of semiconducting materials and solar energy-generated electrons to drive chemical reactions, a principle shared with photovoltaic devices. In this project, I

- synthesized and characterized structure of semiconductor-graphene/silica nanocomposite catalysts, and
- analyzed the photo-catalytic activity of these catalysts through dye degradation in a *self-designed reactor*.

## JOURNAL PUBLICATIONS

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**On the topic of electrolysis, electrolytes, and polyelectrolytes:**

1. Electrostatic Correlation Augmented Self-Consistent Field Theory and Its Application to Polyelectrolyte Brushes  
Chao Duan, Nikhil R. Agrawal, and Rui Wang, *Physical Review Letters* (2025) 134, 048101
2. Understanding long-range opposite-charge repulsion in multivalent salt solutions  
Nikhil R. Agrawal, Carlo Carraro and Rui Wang, *J. Chem. Phys.* 161, 204902 (2024)
3. Nature of overcharging and charge inversion in electrical double layers  
Nikhil R. Agrawal, Chao Duan, and Rui Wang, *J. Phys. Chem. B* 2024, 128, 1, 303–311
4. Ion correlation-driven like-charge attraction in multivalent salt solutions  
Nikhil R. Agrawal, Ravtej Kaur, Carlo Carraro and Rui Wang, *J. Chem. Phys.* 159, 244905 (2023)
5. Non-monotonic salt concentration dependence of inverted electrokinetic flow  
Nikhil R. Agrawal and Rui Wang, *AIChE Journal*, e18269, 2023.

6. Self-consistent description of vapor-liquid interface in ionic fluids  
Nikhil R. Agrawal and Rui Wang, *Physical Review Letters* (2022), 129, 228001.
7. Electrostatic correlation induced ion condensation and charge inversion in multivalent electrolytes  
Nikhil R. Agrawal and Rui Wang, *Journal of Chemical Theory and Computation* (2022), 18, 6271-6280
8. Sturm–Liouville theory inspired method to solve the Modified Gaussian Renormalized Fluctuation theory for electrolytes  
Nikhil R. Agrawal, Carlo Carraro and Rui Wang, *in preparation*.

**On the topic of trickle bed reactors, multiphase reactors, and process intensification:**

1. A first-order segregation phenomenon in fluid-immersed granular systems  
 Prapanch Nair, LAT Cisneros, CRK Windows-Yule, Nikhil R. Agrawal, Shantanu Roy, and Thorsten Pöschel, *Powder Technology* 373 (2020): 357-361.
2. Isotropy of sphere packings in a cylindrical confinement  
Nikhil R. Agrawal, Prapanch Nair, Thorsten Pöschel and Shantanu Roy, *Chemical Engineering Journal* 377 (2019): 119820.

**SELECTED PRESENTATIONS**

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1. **Modified Gaussian Renormalized Fluctuation Theory for Electrolytes at Interfaces**  
 2025 AIChE Annual Meeting, Oral Presentation  
Nikhil R. Agrawal and Rui Wang
2. **Thermodynamics and transport of concentrated electrolytes at interfaces**  
 2025 AIChE Annual Meeting, Poster Presentation  
Nikhil R. Agrawal and Rui Wang
3. **Ion correlation induced non-monotonic height change and microphase separation of poly-electrolyte brushes**  
 2024 American Physical Society March Meeting, Oral Presentation  
 Rui Wang, Chao Duan, Takashi Yokokura, and Nikhil R. Agrawal
4. **Beyond mean-field Poisson-Boltzmann: A self-consistent theory for electrical double layers**  
 Energy Conversion Group, Lawrence Berkeley National Laboratory, Invited Presentation, Feb 2023  
Nikhil R. Agrawal and Rui Wang
5. **Modified Gaussian Renormalized Fluctuation theory: A self-consistent electrolyte solution theory**  
 Pitzer Center for Theoretical Chemistry, UC Berkeley, Invited Presentation, Jan 2023  
Nikhil R. Agrawal and Rui Wang
6. **Self-consistent theory to describe charge inversion and like-charge attraction in multivalent electrolytes**  
 2023 American Physical Society March Meeting, Oral Presentation  
Nikhil R. Agrawal and Rui Wang
7. **A self-consistent theory for complex electrostatic phenomena at interfaces**  
 2022 American Chemical Society Colloid and Surface Science Symposium, Oral Presentation  
Nikhil R. Agrawal and Rui Wang
8. **Beyond mean-field Poisson-Boltzmann: A self-consistent theory for electrical double layers**  
 Formulation and Material Science Division, Dow Chemicals, Invited Presentation, 2022  
Nikhil R. Agrawal

## COURSEWORK AND CERTIFICATIONS

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- Process Engineering for Silicon wafers (Lam Research)
- Process Integration for Semiconductor manufacturing (Lam Research)
- Electroplating for Semiconductor manufacturing (Lam Research)
- Deposition and Etch for Semiconductor manufacturing (Lam Research)
- Fundamentals of Deep Learning (NVIDIA)
- Data Parallelism: How to Train Deep Learning Models on Multiple GPUs (NVIDIA)
- Model Parallelism: Building and Deploying Large Neural Networks (NVIDIA)
- Bayesian Data Analysis and Machine Learning for Physical Sciences (UC Berkeley)
- Machine Learning, Statistical Models, and Optimization for Physical Sciences (UC Berkeley)

## AWARDS AND HONORS

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- Langmuir Graduate Student Oral Presentation Awards Finalist, American Chemical Society 2022
- *Institute Silver Medal* from IIT Delhi for highest GPA in the dual degree program in Chemical Engg. 2018
- IIT Delhi *Semester Merit Award* for 9 out of 10 semesters for being among *top 7%* meritorious students across the dual degree program, *consecutively for 8 semesters* 2013-2017
- *Significant Contribution to Research Activities Award* by Chemical Engineering Society, IIT Delhi 2017
- *Kishore Vaigyanik Protsahan Yojana (KVPY) Fellowship* by Dept. of Science and Technology, India 2013
- Was among the *Nation's Top 1%* merit holders in National Standard Examination in Physics (NSEP) conducted by the Indian Association of Physics Teachers (IAPT) 2013

## LEADERSHIP ROLES

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**Secretary, SPIC MACAY, BRCA, IIT Delhi** 2015 - 2016

SPIC MACAY: *Society for Promotion of Indian Classical Music And Culture Amongst Youth*

One of the 11 club secretaries of the Board of Recreational and Cultural Activities (BRCA), IIT Delhi.

- Led a team of 13, one each from every hostel in IIT Delhi, to organize marketing, publicity, and hospitality of club events like dance workshops and music concerts
- Successfully secured a sponsorship of Rs. 1 lac from the Gas Authority of India Ltd. (GAIL) to organize *Saaz*, the classical music night of Rendezvous 2015 (IIT Delhi's annual cultural festival), where Grammy Award winner Pt. Vishwa Mohan Bhatt performed.
- Overall coordinator of SPIC MACAY's VIRASAT '16, annual classical music festival of IIT Delhi; headed a team of 15 to organize a 2 week long series of cultural events

**Event Coordinator, IIT Delhi Alumni Association** April '16

Lead a team of student volunteers for audience management in a seminar on "Ethics and Happiness" by *Nobel Laureate 14<sup>th</sup> Dalai Lama*

## MISCELLANEOUS

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**Programming Skills**

**Technical softwares**

**Material Characterization**

**Other Interests**

Python, C++, PyTorch, GPyTorch, TensorFlow, Scikit Learn, Bash

JMP, MATLAB, Aspen, COMSOL, FLUENT, ParaView, Autodesk Inventor

XSEM, STEM, SIMS, XRR, CV/IV (Hg Probe).

Sociology, Reading about emerging technologies and their impact on society