

CHE 41100 - CHE 41200 or HONORS RESEARCH PROJECTS
2025-26

Rakesh Agrawal (FRNY 3053D) Phone: 494-2257, agrawalr@purdue.edu

1. Nanocrystal Based Solar Cells
2. Solution Processed Solar Cells
3. Novel and Energy Efficient Separation Processes
4. Modeling of Energy Systems
5. Process Modeling for Shale Gas Processing (CISTAR)

Alina Alexeenko (ARMS3000) Phone: 496-1864, alexeenk@purdue.edu

1. Process modeling for pharmaceutical lyophilization
2. PAT for pharmaceutical lyophilization

Xiaoping Bao (FRNY 1158) Phone: 496-3094, baop61@purdue.edu

1. Stem Cell Immunoengineering for CAR-T and CAR-NK cell therapy;
2. Optogenetic-mediated heart tissue engineering;
3. Hematopoietic stem cell expansion with oxygen-gradient biomaterials

Osman A. Basaran (FRNY 3060) Phone: 494-4061, obasaran@purdue.edu

1. Drop-wise or drop-by-drop processing for making drops, particles and capsules in producing advanced materials and in pharmaceutical engineering (e.g. controlled release and personalized medicine)
2. Fluid mechanics and transport phenomena in coupling between electric (and magnetic) fields and fluid flows: instabilities and patterns in liquid drops, films, and sheets
3. Flow assurance and safety in designing crop protection systems: the quest for zero spray drift
4. Science of complex fluids: bulk rheological and surface rheological effects in flows involving polymeric fluids (e.g. DNA solutions), foams, and surfactant solutions
5. Nonlinear dynamics, chaos, complexity, and systems far from equilibrium
6. Safety and process/product assurance (especially flow assurance) and consequence analysis
7. Large-scale computation/simulation and mathematical modeling: finite elements, asymptotic methods, and more

David E. Bernal Neria (FRNY G027C), dbernaln@purdue.edu

(Honors or 2 semester CHE 41100 commitment)

1. Optimal process Design and Operations
2. Resilient and sustainable supply chains for chemicals
3. Quantum computing applications in chemical engineering

James M. Caruthers (FRNY 2043C) Phone: 494-6625, caruther@purdue.edu

1. Engineering Properties of Polymers
2. Design of unit operations to make lignin binders for composite boards (with Prof. Martinez)

William Clark (FRNY 2158) Phone: 496-8647, clarkw@purdue.edu

1. Hemoadsorption: Design of Experiments (DOE) to Address Unresolved Clinical Questions. (Co-Advised with Vivek Narsimhan)

David S. Corti (FRNY 1060F) Phone: 496-6064, dscorti@purdue.edu

1. Atomic Force Microscopy Measurements of the Hamaker Constants of Solids
2. Molecular Thermodynamics of Model Fluids
3. Developing virtual demonstrations for Thermodynamics and Heat/Mass Transfer

Letian Dou (FRNY 3053B) Phone: 494-4194, dou10@purdue.edu

1. Synthesis and characterization of novel 2D hybrid electronic materials
2. High performance perovskite solar cells and LEDs.

Rajamani P. Gounder (FRNY 2160) Phone: 496-7826, rgounder@purdue.edu

(Honors or 2 semester CHE 41100 commitment)

1. Synthesis of Zeolite Catalysts
2. Catalysis of Nox Abatement
3. Catalysis of Hydrocarbon Conversion

Jeffrey Greeley (FRNY 2154) Phone: 494-1282, jgreeley@purdue.edu

1. Density Functional Theory Studies of Propane Dehydrogenation
2. First Principles Studies of Electrocatalysis

Michael T. Harris (FRNY 3043) Phone: 494-0963, mtharris@purdue.edu

1. Pharmaceutical Powder Characterization Using Microwave Spectroscopy
2. Colloidal Particle Deposition During Drop Evaporation.
3. Hydrothermal Metal Coating on Plant Viruses

Hebner, Tayler (FRNY 2043A), hebner@purdue.edu

1. Designing Liquid Crystalline Elastomers as Stimuli-Responsive Materials
2. Engineering Synthetic Hydrogels to Promote Regenerative Healing in Musculoskeletal Tissues

Can Li (FRNY G027A) Phone: 494-5356, canli@purdue.edu

1. Design and Simulation of an Integrated Ammonia Synthesis Process with CO₂ Capture

Julie C. Liu (FRNY 1160) Phone: 494-1935, julieliu@purdue.edu

(Honors or 2 semester CHE 41100 commitment)

1. Protein-based Biomaterials for Tissue Engineering
2. Designing Surgical Adhesives and Sealants
3. Understanding Nanoparticle Transport for Drug Delivery to the Brain

Enrico N Martinez (Forney G015) Phone: 496-6998, marti309@purdue.edu

1. Biodiesel from Spent Coffee Grounds
2. Jet Fuel from Vegetable Oils
3. Lignin conversion to bio-fuels and high value-added chemicals (with Prof. Caruthers)

Cornelius Masuku (FRNY 1060) Phone: 496-2538, cmasuku@purdue.edu

1. Electric Steam Methane Reformer Design for Hydrogen Production
2. Life Cycle and Techno-Economic Analyses for Net-Zero Fuels and Chemicals Production

Ray Mentzer (FRNY 3019) Phone: 936-443-5579, rmentzer@purdue.edu

1. Continued evaluation of AI (Chat GPT, ...) for performing process safety calculations.
2. Comparison of experimental data with calculations from CHETAH (ASTM) and TCIT (Purdue) models.
3. Continued development of model that can predict dispersion of H₂S and ammonia as a result of a sour water release and extend to rich amines.
4. Laboratory study with ARSST calorimeter of key thermal characteristics of common pharmaceutical reagents.

Jeffrey T. Miller (FRNY 2152) Phone: 496-0462, mill1194@purdue.edu

1. Determination of the mechanism of high temperature Lewis acid, olefin oligomerization catalysts
2. Determination of the mechanism of main group alkane dehydrogenation catalysts

John A. Morgan (FRNY 1053) Phone: 494-4088, jamorgan@ecn.purdue.edu

(Honors or 2 semester CHE 41100 commitment)

1. Biosynthesis of aromatics from CO₂
2. Mass transfer of volatiles from plants

Zoltan K. Nagy (FRNY G027D) Phone: 494-0734, zknagy@purdue.edu

1. Process intensification and advanced control of crystallization systems
2. Digital design of pharmaceutical manufacturing systems
3. Right-first-time continuous manufacturing of pharmaceutical tablets
4. Smart manufacturing of particulate products
5. Process design and control of miniaturized pharmaceutical manufacturing plants (MiniPharms) for distributed manufacturing

Vivek Narsimhan (FRNY 1029B) Phone: 494-4282, vnarsim@purdue.edu

1. Effect of fouling on dialysis membrane transport characteristics (Co-Advised with William Clark)
2. Analysis of new flow configurations for hollow fiber dialysis devices (Co-Advised with William Clark)
3. Separation of particulates using microfluidics
4. Droplet dynamics with complex membranes
5. Modeling and experiments of red blood cells and vesicles under flow
6. Modeling and experiments to predict the texture of starches during swelling/pasting
7. Mass and heat transfer during freeze drying

Vilas G. Pol (FRNY 2146) Phone: 494-0044, vpol@purdue.edu

1. Energy Harvesting and Storage at Ultralow (below -100 degree Celsius).
2. All Solid-State Safer Batteries using Polymer Based Composite Electrolytes
3. Next Generation High Energy Li-S Batteries
4. *In situ* Diagnostics of Batteries for their Safety Understanding
5. Enhanced Lithium-ion Storage at Ultralow Temperatures
6. Fireproof, Bulletproof Batteries

Doraiswami (Ramki) Ramkrishna (FRNY 1164) Phone: 494-4066, ramkrish@ecn.purdue.edu

1. Bioreactor Modeling and Control
2. Computer Simulation of Advanced Materials
3. Modeling of Antibiotic Resistance in Bacteria
4. Simulating Phase Transitions for Advanced Materials Design
5. Modeling Metabolic Regulation and Control (based on small networks and omic data)
6. Modeling of the Microbiome
7. Mixing and Agglomeration in an Agitated Dryer

G. V. Reklaitis (FRNY G027B) Phone: 494-9662, reklaiti@purdue.edu

1. Real Time Operations Management of continuous pharmaceutical manufacturing
2. On-line process sensors and sensor network performance in Continuous Manufacturing of Tablets
3. Modeling & sensing of dust dispersions arising in pharmaceutical manufacturing

Fabio H. Ribeiro (FRNY 2158) Phone: 494-7799, fabio@ecn.purdue.edu

1. Shale Oil and Gas as a Bridge Fuel: Dehydrogenation of Alkanes
2. Shale Oil and as a Bridge Fuel: Oligomerization of Olefins
3. Shale Oil and as a Bridge Fuel: Methane Activation

Brett Savoie (FRNY 2043A) Phone: 765-494-4235, bsavoie@purdue.edu

(Honors or two semester CHE 41100 commitment)

1. Machine learning models of chemical reactions
2. Physics-based modeling of reaction networks.

Kendall Thomson (FRNY 1152) Phone: 496-6706, thomsonk@ecn.purdue.edu

Honors two-semester commitments or CHE 41100 for summer

1. Computational Analysis of Direct Epoxidation Pathways on Au-Supported Titanosilicates
2. Computational Analysis of Cu(I)-Catalyzed Aryl-Halide Coupling Systems for Pharmaceuticals Synthesis

Nien-Hwa Linda Wang (FRNY 1015) Phone: 494-4081, wangn@ecn.purdue.edu

Two semester commitment of CHE 41100 or 41200, or Honors BS Thesis

1. Continuous Chromatography
2. Separation and Purification of Rare Earth Elements and Other Critical Materials
3. Conversion of Plastic Waste into Valuable Products

You-Yeon Won (FRNY 2031) Phone: 494-4077, yywon@ecn.purdue.edu
(Honors or 2 semester CHE 41100 commitment)

1. Polymer Lung Surfactant
2. Polymer Drug/Gene Delivery
3. Nanoparticle Radiation Therapy

Chongli Yuan (FRNY 1154) Phone: 494-5824, cyuan@ecn.purdue.edu
(Honors or 2 semester CHE 41100 commitment)

1. Reconstitution of synthetic neuronal network via bioengineering
2. Monitor environmental chemical impact on long-term human health using stem cells.
3. Single cell fluorescent tools for tracking tumor cell heterogeneity.