CHE 41100 - CHE 41200 or HONORS RESEARCH PROJECTS
2023-24

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, bao61@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@ecn.purdue.edu
1. Drop Dynamics: Experimental Analysis and Ultra-Fast (Down To 10 Ns) Imaging of Singularities during Drop Formation, Drop Coalescence, and Drop Impact
2. Crop Protection Systems and Aiming for Zero Spray Drift
3. Drop-Based Methods for Making Particles and Capsules for Pharmaceutical (E.G. Controlled Release) and Materials Science Applications
4. Ink Jet Printing
5. Complex Fluids: Polymeric Fluids (E.G. DNA Solutions), Foams, And Surfactant Solutions
6. Nonlinear Dynamics and Chaos in Chemical Engineering
7. Safety and Process/Product Assurance (Especially Flow Assurance)
8. Mathematical Analysis and Computing: Finite Elements and Asymptotic Methods

Bryan W. Boudouris (FRNY 1051) Phone: 496-6056, boudouris@purdue.edu
1. Synthesis of New Polymers
2. Design of Energetic Materials

James M. Caruthers (FRNY 2043C) Phone: 494-6625, caruther@ecn.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. Effect of fouling on dialysis membrane transport characteristics (Co-Advised with Vivek Narsimhan)
2. Analysis of new flow configurations for hollow fiber dialysis devices (Co-Advised with Vivek Narsimhan)

David S. Corti (FRNY 1055) Phone: 496-6064, dscorti@ecn.purdue.edu
1. Colloidal Stability of High-Density Particle Dispersions (Co-Advised With Prof. Franses)
2. AFM Measurement of the Hamaker Constants of Solids
3. Molecular Thermodynamics of Model Fluids
4. 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@ecn.purdue.edu
1. Pharmaceutical Powder Characterization Using Microwave Spectroscopy
2. Colloidal Particle Deposition During Drop Evaporation.
3. Hydrothermal Metal Coating on Plant Viruses

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

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

Cornelius Masuku (FRNY 1060) Phone: 496-2538, cmasuku@purdue.edu
1. Evaluation of Potential Scenarios for Future Fuels and Energy Growth
2. Integrated Energy Systems Planning and Modeling

Ray Mentzer (FRNY 3019) Phone: 936-443-5579, rmentzer@purdue.edu
1. Develop a summary of process safety risks in alternative energy, including type (e.g., wind, solar, hydrogen fuel cells, battery storage …), how likely/severe, what hazards, typical mitigations and if there have been any incidents. (Marsh)
2. 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. (P66)
3. Literature survey of the best practices for secondary containment of liquid storage vessels, including examples of incidents where failure in primary containment led to further incidents (e.g., TCC fire-fighting foam impacting water supply). While there currently is no standard, API and regulators are studying this issue. (ACC)
4. Impact of water spray in arresting thermal runaway inside vessel. Continued study of kinetics, vessel geometry, etc. using COMSOL model. (Dow)
5. Continued laboratory study with ARSST calorimeter of key thermal characteristics of common pharmaceutical reagents. - Bai
6. Continued study of heats of reaction for common reaction types in pharma industry. Comparison of experimental data calculations from CHETAH (ASTM) and TCIT (Purdue) models. – Humes & Young
7. Lightning strikes can be a serious hazard particularly for storage tanks. What are the options to mitigate and best practices. See API 656 and OECD publications. (ACC)
8. There is current focus on GHG reporting across industries. How are the numbers being calculated and reported and how is abatement technology factored in? Are the numbers consistent across industries, so they can be compared? (ACC)
9. Calculation of peak overpressures and associated consequences with the mass of various pharmaceutical reagents using TNT analysis and probit correlation. (Lilly)

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
3. Catalytic conversion of greenhouse gases to chemicals and fuels

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

Vilas G. Pol (FRNY 2146) Phone: 494-0044, vpol@purdue.edu
1. All Solid State Safer Batteries using Polymer Based Electrolytes
2. Synthesis of New Electrode Materials, Characterization and Li ion Battery Testing
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 for Space Applications
6. Fireproof, Bulletproof Batteries for Defense Applications

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(1)-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.