



COLORADOSCHOOL OF**MINES**



CHEMICAL AND BIOLOGICAL ENGINEERING DEPARTMENT

Graduate Program



Colorado School of Mines

Founded in 1874 as the first college in the state

A public, state supported university of science and engineering

6000 total students

4600 undergraduates

1400 graduate students

15:1 student to faculty ratio



PhD Program Curriculum

Chemical Engineering Core

Applied Math in Chemical Engineering (CBEN 507)

Advanced Thermodynamics (CBEN509)

Advanced Kinetics (CBEN518)

Introduction to Chemical Engineering Research and Teaching (CBEN568)

Transport Phenomena (CBEN516)

Additional Curriculum

6 hours (2 courses) chemical engineering electives

12 hours (4 courses) additional electives

Colloquium (CBEN605) every semester

Thesis research credits (42 credits)

Minimum of 72 credit hours total



PhD Program Timeline

1. Qualifying Exam: January of 1st year
 - 50% core GPA + 50% written and oral proposal
2. Students are assigned to a research group: January of 1st year
3. PhD Proposal: Before beginning of 5th semester (3rd year)
 - Literature review, preliminary data, and proposal in a written document and an oral defense with your thesis committee
 - PhD Defense: Typically 4.5–5 years following matriculation



Research Advisor Selection

- ▶ Project descriptions will be provided to you in September. Faculty will make presentations about their projects over the course of the semester.
- ▶ Make appointments with faculty members with projects of interest to you.
- ▶ Turn in your top 3 choices by December 1.
- ▶ Advisors are assigned in early January shortly after the Oral component of the Qualifying Exam

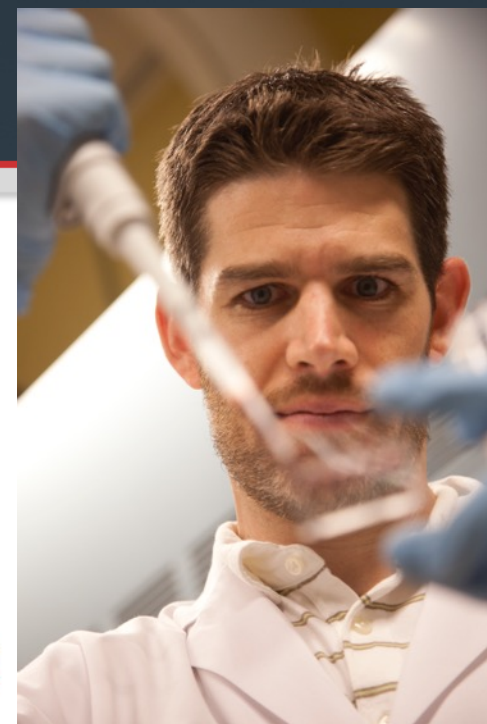


Research Portfolio

Approximately \$8 million in annual research awards.

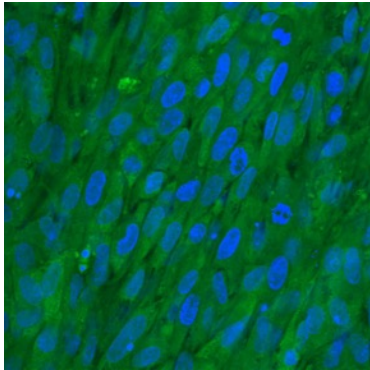
Research area include bioengineering, conventional energy conversion, hydrates, renewable energy, simulation and modeling, soft materials, and electronic materials.

Strong collaboration and research opportunities with the National Renewable Energy Laboratory, Children's Hospital Colorado, National Institutes of Standards and Technology.

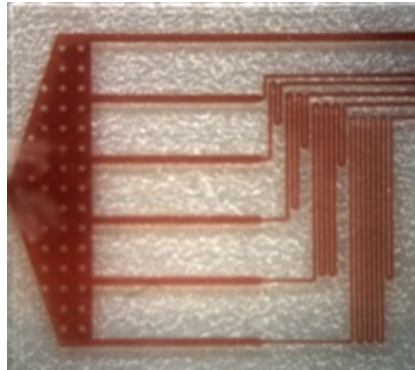


Bioengineering

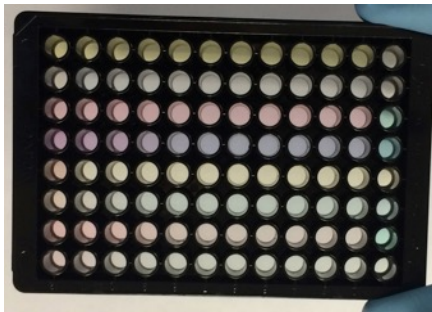
(Boyle, Cash, Krebs, Marr, Neeves)



Human trabecular meshwork cells seeded on collagen scaffolds

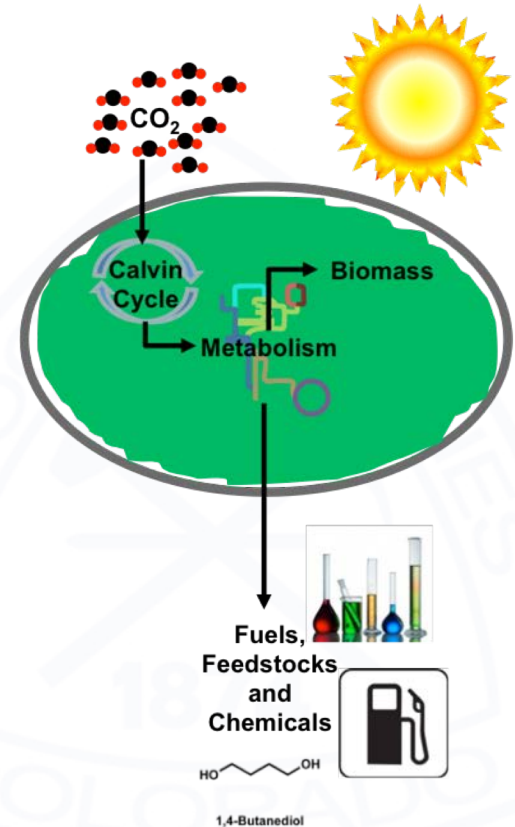


Microfluidic model of vascular injury



Nanosensors for in vivo monitoring of metabolites

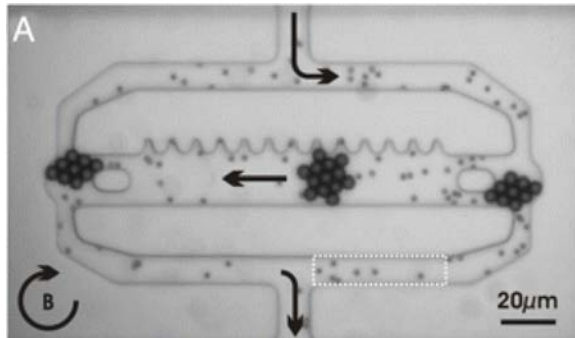
Biosensors
Diagnostics
Drug delivery
Metabolic engineering
Microfluidics
Tissue engineering



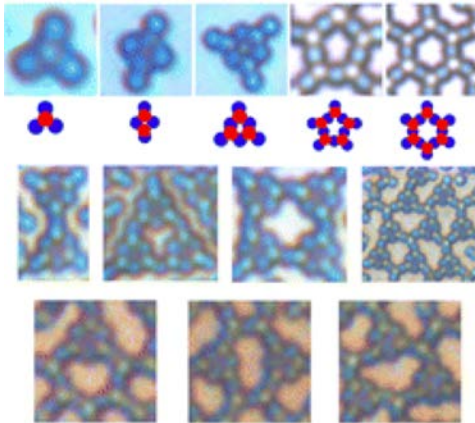
Metabolic engineering of photosynthetic organisms

Soft Matter

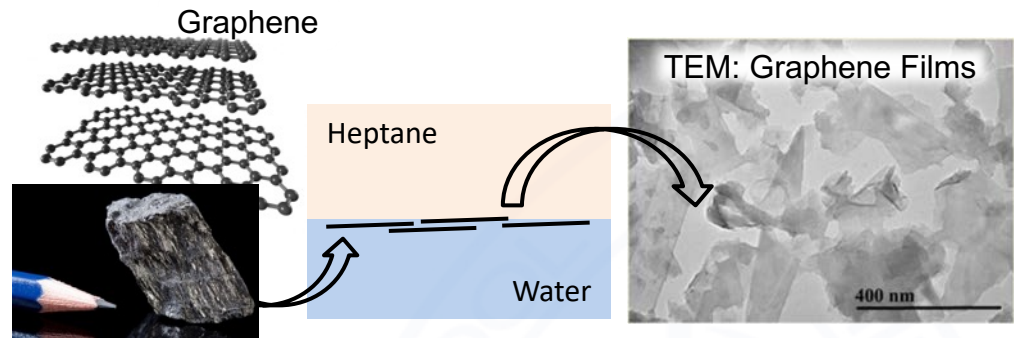
(Herring, Krebs, Marr, Neeves, Samaniuk, N. Wu)



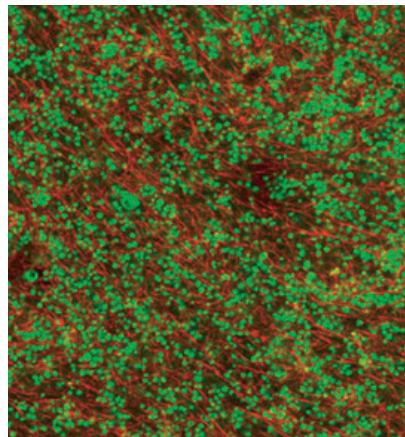
Magnetically actuated colloid pump and valves



Colloidal molecules assembled by electric fields



Dynamics of fluid-fluid interfaces



Rheology of tissues

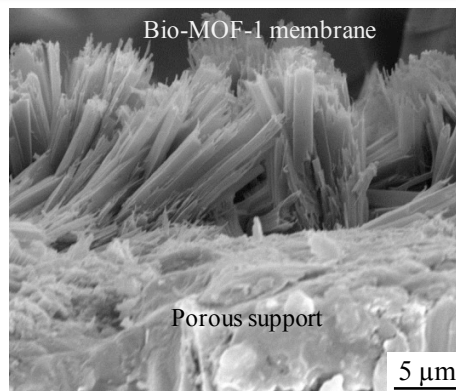
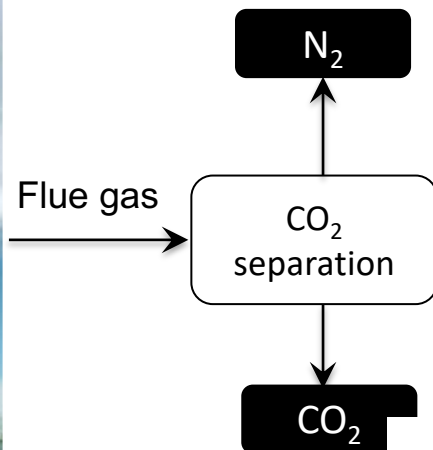
Colloids
Complex fluids
Interfacial rheology
Micropropulsion
Polymers

Membranes and Catalysis

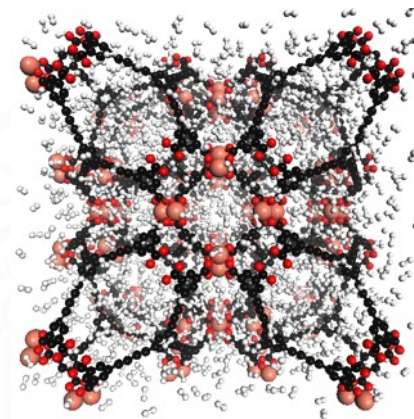
(Carreon, Gomez–Gualdron, Herring, Way, Wilcox)



Post-combustion capture and conversion

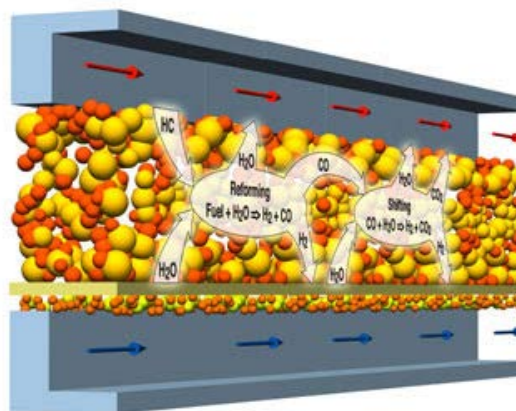


Metal-organic frameworks for CO2 capture



Computational design of materials for energy applications

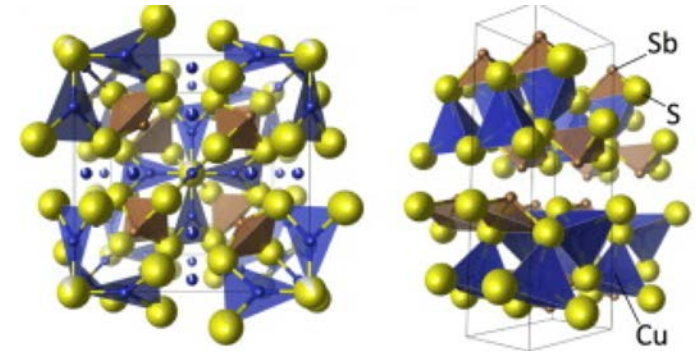
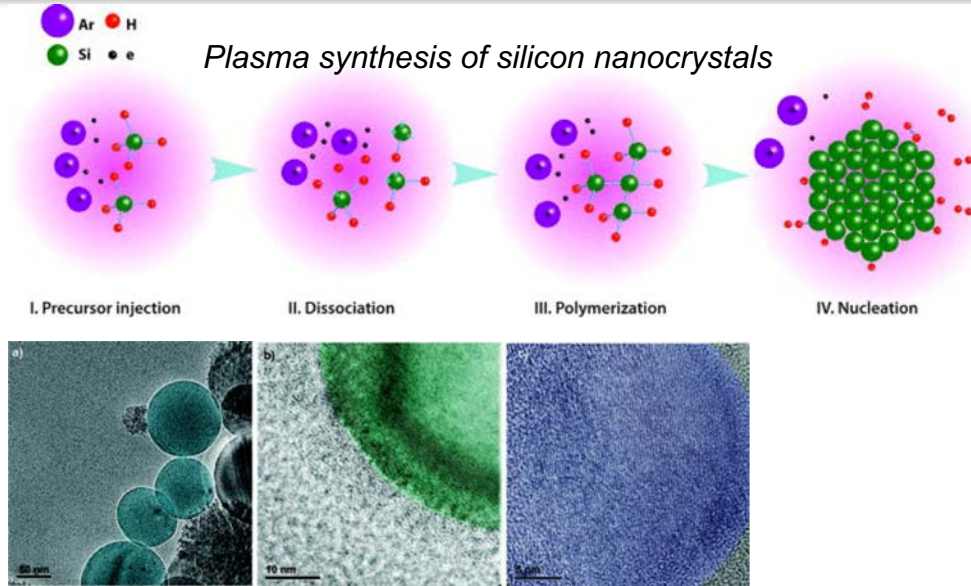
Carbon capture
Catalytic membrane reactors
Fuel cells
Hydrogen purification
Zeolite membranes



Design and simulation of proton exchange membranes

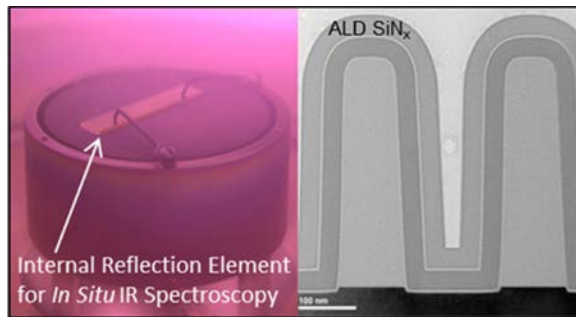


Solar and Electronic Materials (Agarwal, Wolden, N. Wu)



CuSbS₂ solar absorber

Thin film synthesis
Plasma processing
Colloidal synthesis



Atomic layer deposition

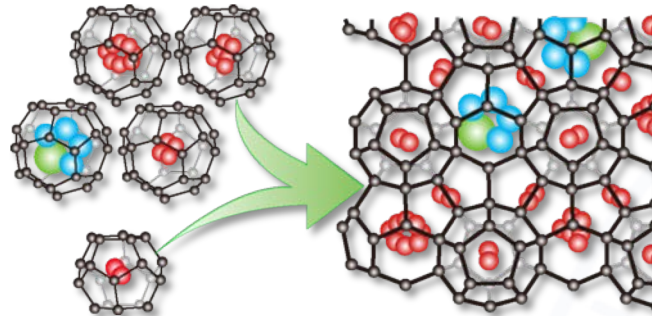


Hydrates (Koh, Sum)

Hydrates in *Flow Assurance*



Hydrates in *Science*



Hydrates in *Nature*



FOR **H** RESEARCH
CENTER HYDRATE

Benefits

PhD graduate research assistants

- Annual stipend \$27,000
- Fully paid tuition, fees, health insurance
- Total value: >\$60,000/year



15 miles from downtown Denver...



...minutes from world class outdoor recreation



Where do our graduates get jobs?

▶ Industry

- Oil and Gas: ConocoPhillips, Exxon, Haliburton
- Chemical: Pall, Dow, DuPont, Cargill
- Biotech: NovoNordisk, Cerus, Horiba
- Semiconductor: Intel, Motorola, Sun
- Beer: Mountain Toad, New Terrain, Coors

▶ National Laboratories

- NREL, ORNL, LLNL

▶ Academia

- Kansas State, Carnegie Mellon, University of Colorado, Stanford, Oregon Health & Sciences University



Questions? Contact

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