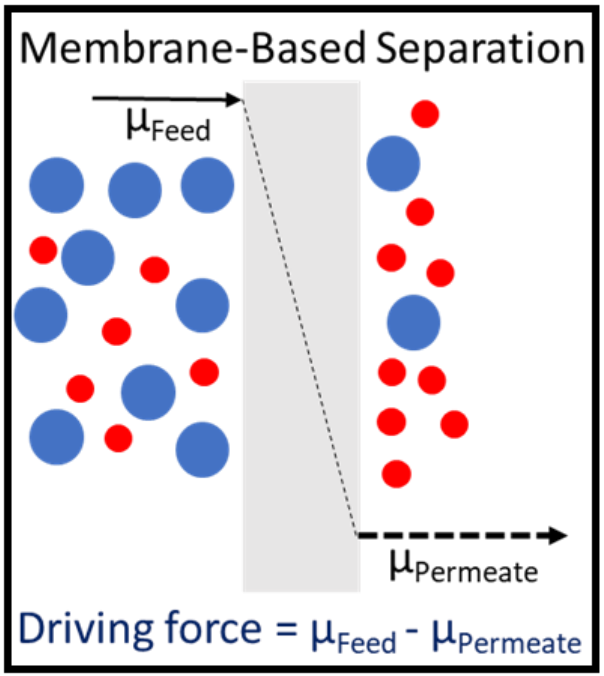
SUMMER RESEARCH OPPORTUNITIES IN CHEMICAL ENGINEERING

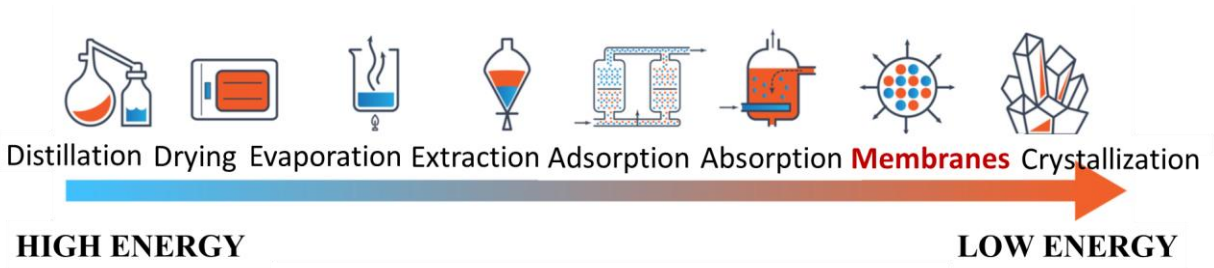
Molecular Transport and Separations Lab
P.I – Dr. Oishi Sanyal

Department of Chemical and Biomedical Engineering
West Virginia University

https://oishisanyal.com/

Overview of membranes research





Cost-effective separation tools
→ (i) $4 billion in energy costs/year
→ (ii) reduced CO_2 emission by 100 million tons/ year

- Typically, a pressure-driven process
- No phase-separation involved
- Compact, scalable

Goal of our research program

Overarching goal : To develop advanced membranes as the next-generation separation tools for non-traditional liquid separation and challenging gas separation applications

Tentative SURE projects

Sustainable extraction of valuable earth elements from acid mine drainage

(In collaboration with WVU Mining)

AMD cleanup

Recovery of REEs

Solvent precipitation

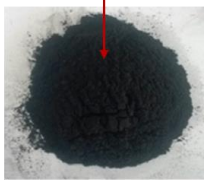
Membrane separation

Sorbent based separation

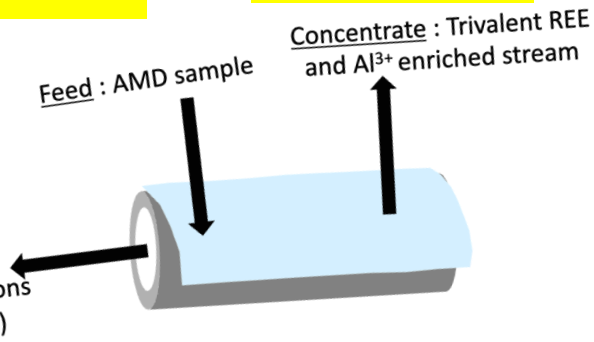
Functionalization for specific elements

Sorbents

Membranes

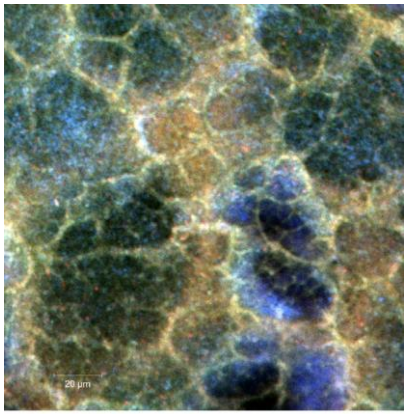


Biochar



Understanding biofilm formation mechanisms on porous membranes

(In collaboration with UPitt)



Biofilm formation leads to membrane performance decline over time

Questions that we are trying to answer :

1. How does the biofilm interact with the (a) membrane surface and (b) membrane pores

1. How does the interaction change while “in-operation”?

Current undergraduate researchers

CHE sophomore :
Alyssa Mize

CHE Juniors :
Grace Cunningham (with Mining department)
Michael Ferrebee
Nhan Khuu
Shawn Stephens

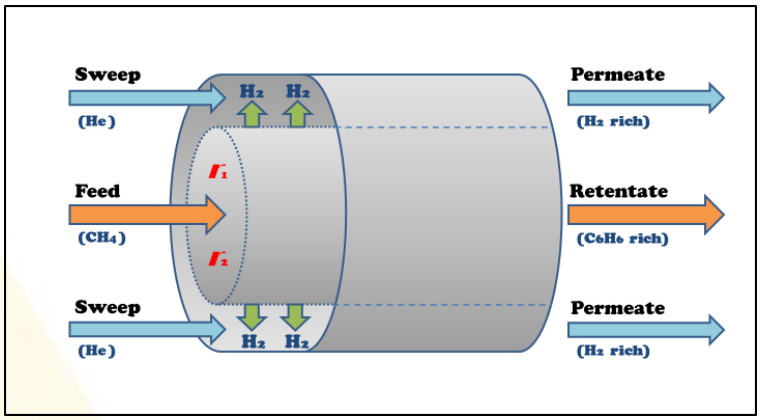
CHE Seniors :
Abigail Paul (with Mining department)
Rebecca Erwin

Lima Research Group: UG Research Directions

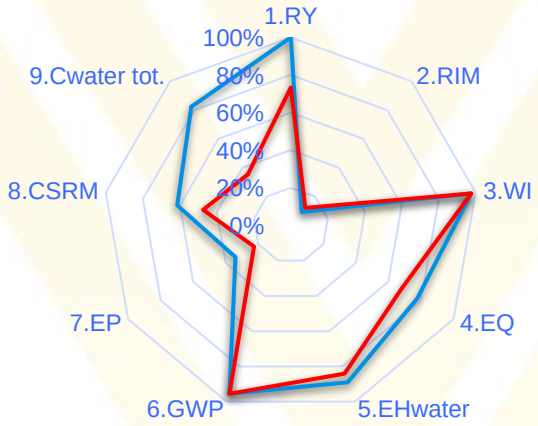
➢ Research Directions – All Computational

- ✓ Process Modeling and Simulation
- ✓ Process Design and Optimization
- ✓ Process Control
- ✓ Sustainability Assessment
- ✓ Main Software: MATLAB/Python, CHEMCAD/Aspen/AVEVA
- ✓ Applications: Emerging Energy Systems (H_2 production/separation, shale gas conversion, renewables, decarbonization)

Membrane Reactor for Methane Conversion to Fuels and Chemicals



Sustainability Assessment for Bio/Chemical Systems



Lima Research Group: UG Research Opportunities

- **Research Opportunities**
  - ✓ Credit – ChE 495, 497, 498 (All)
  - ✓ Research Apprenticeship Program (RAP, All)
  - ✓ Honors Excel (Sophomores, GPA ≥ 3.4)
  - ✓ SURE (All, GPA ≥ 3.5)
  - ✓ NSF-REU (All, GPA ≥ 3.5 recommended)

- **Former students (> 50 UG) – placement and accomplishments**
  - ✓ Graduate School (offers from WVU, Purdue, CMU, MN, GA Tech, ND, Lehigh, etc.)
  - ✓ Industry (DuPont, Chemours, Dow, Procter & Gamble, AstraZeneca, Worley, Bayer, etc.)
  - ✓ Research Awards: AIChE Poster (7), SURE Recipients (9)

Lima Research Group: Application

- **Current Undergraduate Roster (from WVU)**
  - ✓ **Seniors (3): Kevin Donnelly, Savannah Sakhai, Antonio Mascaro**
  - ✓ **Juniors (2): Ashley McCullough, Lillian Bischof**
  - ✓ **Sophomores: Looking for Sophomores!**

- **Application**
  - ✓ **Submit by February 21**
  - ✓ **CV/Resume (1-2 pages with previous research experiences (if any) and interests as well as current GPA)**
  - ✓ **SURE deadline of March 2!**

Contact: Fernando.Lima@mail.wvu.edu;
CODES Group Website: https://fernandolima.faculty.wvu.edu/

Catalyst Design Lab

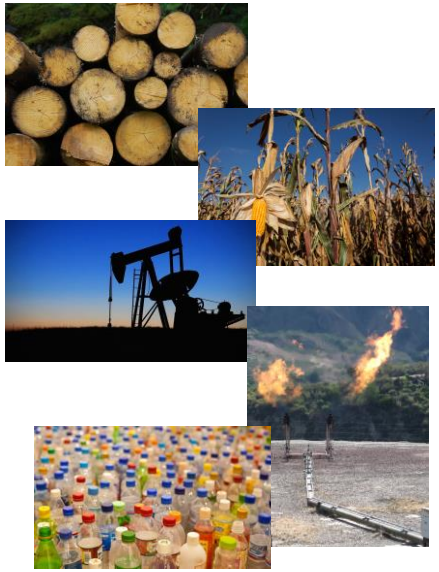
PI: Dr. Madelyn Ball

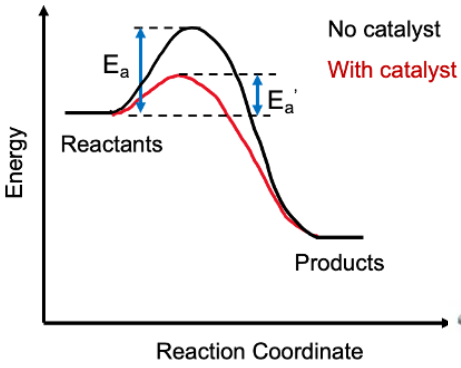
Addressing sustainability challenges through experimental materials design

Combined approach involving:

- Catalyst synthesis
- Characterization (FTIR, chemisorption, TGA)
- Reactivity measurements

Primary project would involve one of these thrusts





Catalyst development for CO_2 conversion to high value products

Interested?

Email: madelyn.ball@mail.wvu.edu
https://madelynball.faculty.wvu.edu/

Send: CV/resume with GPA, brief summary of your interest in my lab, specific times you are available for a meeting

For summer: contact me by Feb 21 (SURE deadline March 2)

Current Undergrads

Ray Gerner (junior)
Meghan Boyczuk (sophomore)
Mani Harrah (first year)