

CHEMICAL AND ENVIRONMENTAL ENGINEERING  
COLLEGE OF ENGINEERING AND APPLIED SCIENCE

RESEARCH OPPORTUNITIES FOR UNDERGRADUATE students

APPLICATION DEADLINE: April 3, 2026

PROJECT TITLE: Developing and Testing a Direct Air Capture Prototype using Energy-Efficient and Robust Sorbent Technology

Physical Requirement :

Must be able to lift 20 lbs

Project's Technical Skills Requirement :

Good verbal and written communication skills; Mass and energy balances; and Familiarity with fundamental heat- and mass-transfer principles

Project's Available Positions : Undergraduate co-op for Fall 2026

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### Project Description

Developing and Testing a Direct Air Capture Prototype using Energy-Efficient and Robust Sorbent Technology

CO<sub>2</sub> emissions from distributed sources and the transportation sector in the U.S. account for ~33-50% of total CO<sub>2</sub> emissions and are very difficult to control. Direct air capture (DAC) is advantageous to mitigating such CO<sub>2</sub> emissions. However, current state-of-the-art CO<sub>2</sub> mitigation technologies have many technical challenges to overcome. Adsorption-based sorbent technology has the highest potential to achieve the most economical CO<sub>2</sub> separation from ambient air. Among many challenges, sorbent cost associated with lifetime and heat of desorption are the two primary hurdles to overcome. Dr. Lee's lab developed a patent-pending cutting-edge DAC sorbent technology that can save ~50% energy for desorption with much longer sorbent lifetime. This project is going to demonstrate the potential of this sorbent technology in a heat exchanger design with fast heating and cooling, low desorption energy requirements, and maximum CO<sub>2</sub> separation productivity. This research project will be conducted by manufacturing and evaluating a fully-automated prototype in Dr. Lee's lab. A successful research co-op candidate will work with Dr. Lee's PhD student on setting up, starting up, and evaluating the performance of the prototype.

Preferred skills include:

- Good verbal and written communication skills;

- Mass and energy balances; and
- Familiarity with fundamental heat- and mass-transfer principles

Training includes:

- Instruments for CO<sub>2</sub>/water vapor measurements, thermogravimetric analysis, and mass spectrometry;
- Data acquisition system set-up;
- Data analysis;
- Modeling and analysis (if student is desired); and
- Co-authorship for research publications