## 

## UNDERGRADUATE RESEARCH CO-OP FELLOWSHIP (URCF)

#### DEPARTMENT OF CIVIL AND ARCHITECTURAL ENGINEERING AND CONSTRUCTION MANAGEMENT COLLEGE OF ENGINEERING AND APPLIED SCIENCE

RESEARCH OPPORTUNITIES FOR UNDERGRADUATE students

APPLICATION DEADLINE: April 27, 2025

PROJECT TITLE: <u>Characterizing an advanced high-resolution mass spectrometer for</u> <u>online measuring organic gaseous air pollutants</u>

Physical Requirement : Must be able to lift 20 lbs Project's Technical Skills Requirement : No specific requirement Project's Available Positions : 1

Tianre Wu, Department of Civil and Architectural Engineering and Construction Management College of Engineering and Applied Science 798 Rhodes Hall Cincinnati, OH 45221 wutr@ucmail.uc.edu Phone: 513-556-1181

#### Project Description

This project is related to environmental engineering, air pollution, environmental chemistry, and analytical chemistry.

Gaseous organic compounds are common air pollutants emitted from diverse sources, including traffic, industrial activities, combustion processes, chemical products, and building materials. Exposure to many of these compounds—such as formaldehyde and aromatic hydrocarbons—has been associated with discomfort, impaired cognitive function, and adverse health effects ranging from irritation and respiratory symptoms to neurological disorders and cancer. Advancing analytical techniques for detecting gaseous organic compounds is essential for accurately quantifying inhalation exposure, studying pollutant formation processes, and protecting public health.

Dr. Wu's lab has recently adopted a novel atmospheric pressure chemical ionization technique with multiple types of primary reagent ions, including ammonium, urea, and bromide, to be coupled with an advanced Orbitrap mass spectrometer to enable real-time measurement of a wide range of gaseous organic compounds. However, the performance of this new setup for compound identification and quantification remains largely untested.

The objective of this study is to characterize the performance of the Orbitrap mass spectrometer with the multi-scheme chemical ionization technique for online measuring organic gaseous air pollutants. To achieve this, the student will:

# 

### UNDERGRADUATE RESEARCH CO-OP FELLOWSHIP (URCF)

 Design, build, and validate a calibration device that can generate the calibration standards of gaseous organic compounds.
Quantify the sensitivity of the Orbitrap mass spectrometer with the multischeme chemical ionization technique for a wide range of gaseous organic compounds.

This project will result in the development of a new functional calibration device and will advance analytical techniques for online quantification of organic gaseous air pollutants. The student will gain valuable research experience in environmental chemistry, analytical chemistry, project planning, and instrumentation development.