

DEPARTMENT OF CHEMICAL AND ENVIRONMENTAL ENGINEERING  
COLLEGE OF ENGINEERING AND APPLIED SCIENCE

RESEARCH OPPORTUNITIES FOR UNDERGRADUATE students

APPLICATION DEADLINE: April 3, 2026

PROJECT TITLE: Development of Nanocrystalline Solid Oxide Electrolyte Membranes for High-Temperature Water Electrolyzer

Physical Requirement :

Ability to perform chemical and materials lab work

Project's Technical Skills Requirement :

Basic training in chemistry, material science, or chemical engineering labs; and good writing skill is a plus

Project's Available Positions : 1

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### Project Description

Oxygen ion conducting solid oxide electrolyzer cells (O-SOECs) can play a vital role in future sustainable energy and green chemicals production through the electrolysis of water and electrochemical reduction of CO<sub>2</sub> using renewable power supply. The O-SOECs offer high efficiency because of reduced reversible cell potential and overpotentials and eliminate the need for precious metal catalysts. However, conventional SOEC materials face serious challenges of interface instability at high temperatures (>750°C) and inadequate conductivity and catalytic activity at low temperatures (<750°C). Dr. Junhang Dong, Rieveschl Eminent Scholar Chair in Membrane Science and Technology in CEAS, has been developing nanocrystalline solid oxide electrolyte membranes with high ion-conductivity at low temperatures (500 ~ 750°C). The objective of this co-op project is to develop an effective methodology for synthesizing various types of nanocrystalline ion-conducting metal oxide nanocrystalline particles and thin membranes that can enable the O-SOECs and solid oxide fuel cells (SOFC) to operate efficiently at reduced temperatures (<750°C).

This research project is sponsored by the U.S. Department of Energy. The research activities will be carried out by the co-op students in collaboration with graduate students and postdoc fellows in Dr. Dong's Laboratory of Membrane Technology located in Mantei Center.

Minimum requirements and desirable skills include:

- Rising junior or rising senior with a GPA above 3.4/4.0
- Experimental report writing

Training provided:

- Fabrication of nanocrystalline solid oxide thin membranes
- Advanced materials characterization by SEM-EDS, TEM, and XRD
- Measurements of the membrane ion conductivity
- Test of membrane performance in O-SOECs
- Potential journal and/or conference publications of research results