

Project Overview [DE-FE0031709]

Overall Project Objectives

- Develop solid oxide electrolysis process for simultaneous conversion of CO₂ and wet natural gas (WNG) into CO and chemicals/fuels

Funding

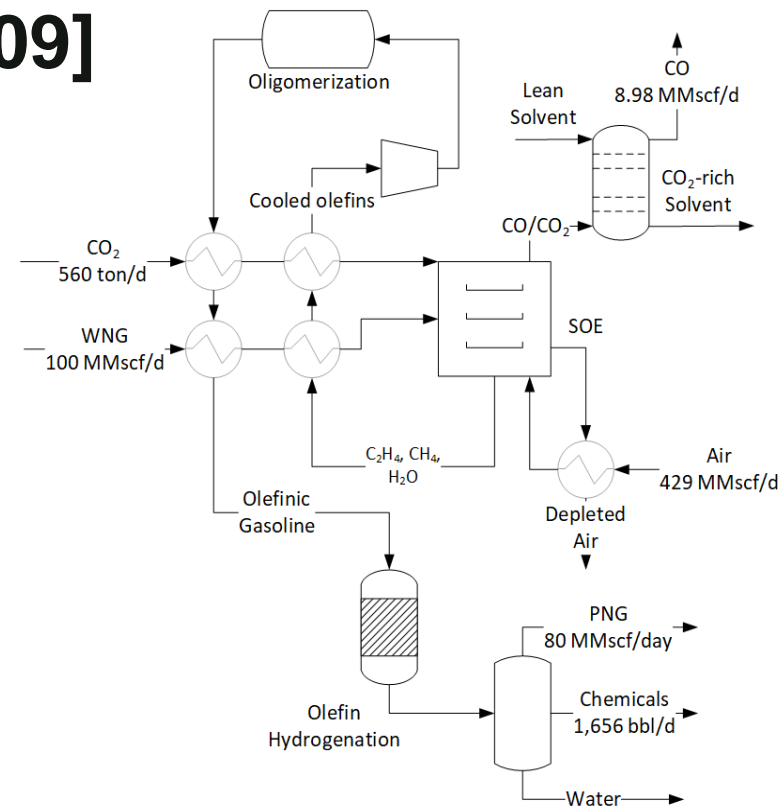
- DOE: \$800,000
- Cost Share: \$200,000

Performance Dates

- Start Date: January 1, 2019
- End Date: December 31, 2021

Project Participants

- Ohio University (OHIO) and Consultant (Dr. Hamid Sarv)
- DOE FPM: Mr. David Lang



Proposed CO₂ Utilization Process

Technical Background

SOEC Design

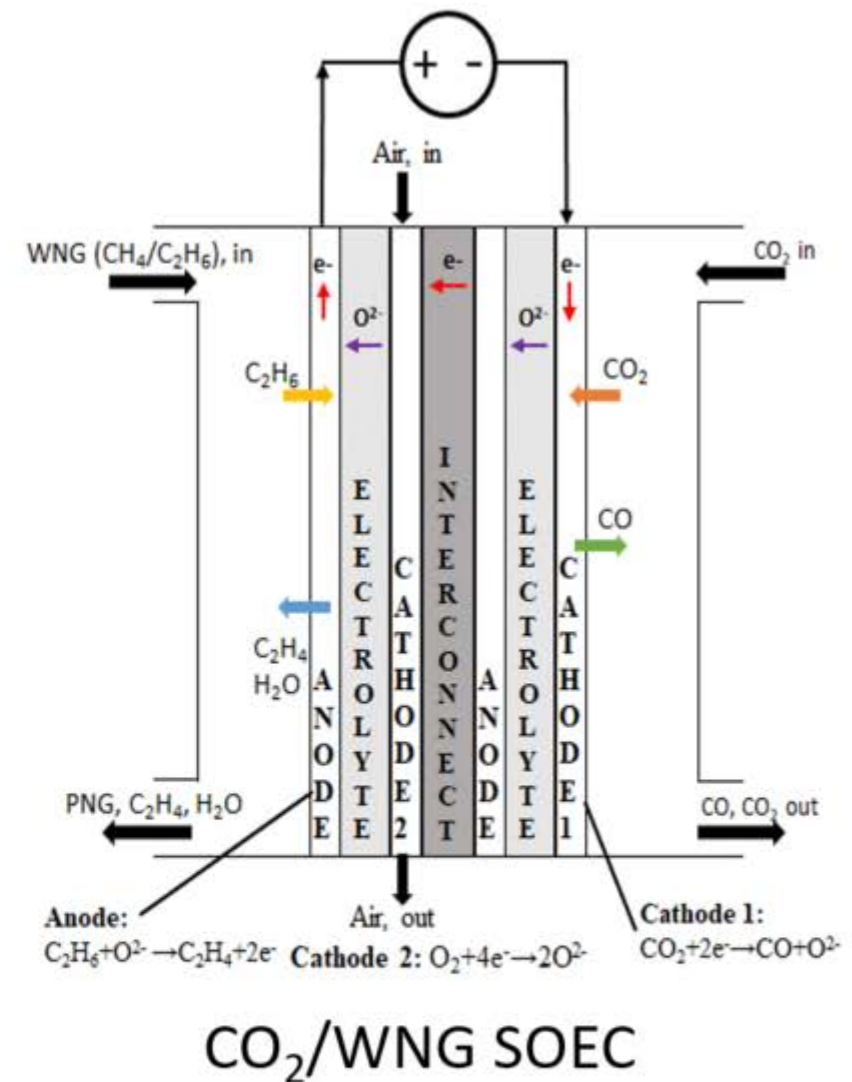
- Dual cell design
- Effective thermal integration
- Multiple value-added products

Cathode: CO₂ Electrolysis

- Generates CO product
- Research Focus: Transition metal electrocatalyst

Anode: NGL Oxidative Dehydrogenation

- Generates alkenes as products
- Research focus: Mixed-oxide electrocatalysts



Technical Background

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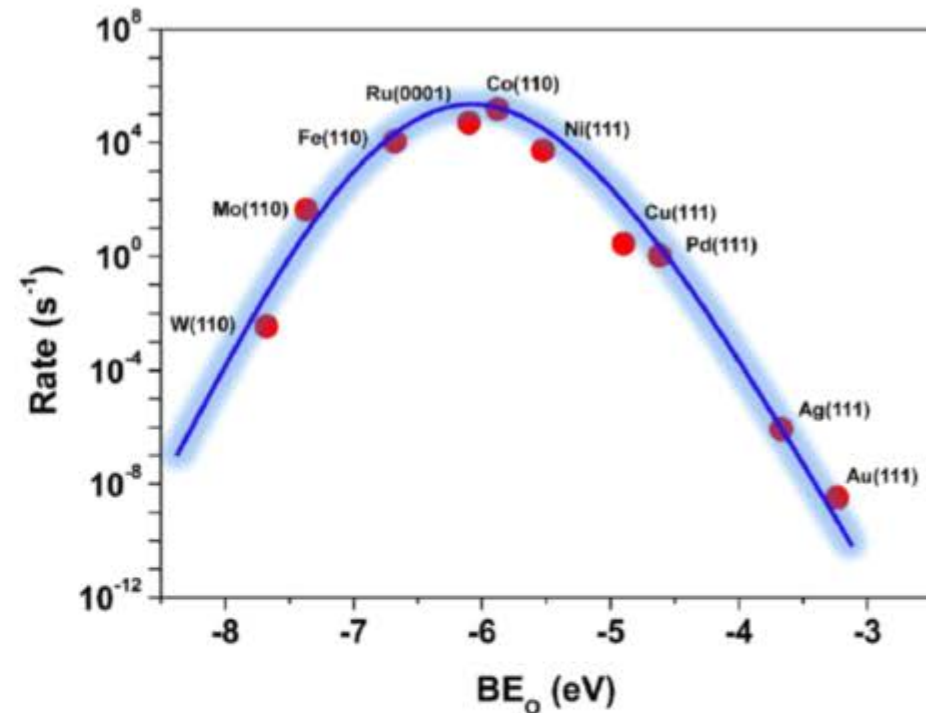
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DFT Analyses for CO₂ Electrolysis [1]

1. Ind. Eng. Chem. Res. 2017, 56, 6155–6163



OHIO
UNIVERSITY

RUSS COLLEGE OF ENGINEERING
AND TECHNOLOGY

Technical Background

SOEC Design

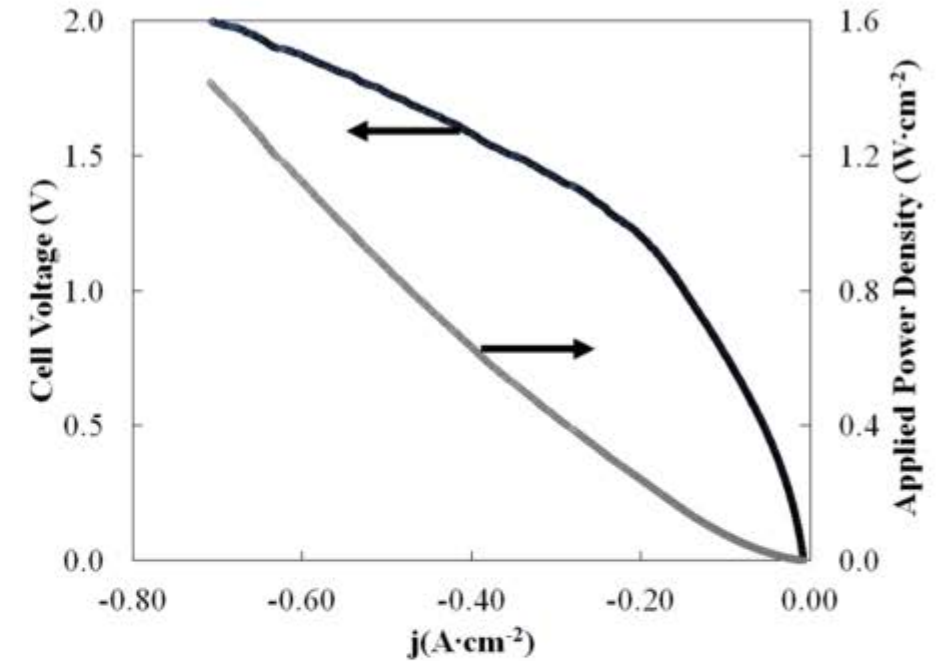
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Preliminary CO₂
Electrolysis Results at
750 °C w/ Ni electrode



Technical Background

SOEC Design

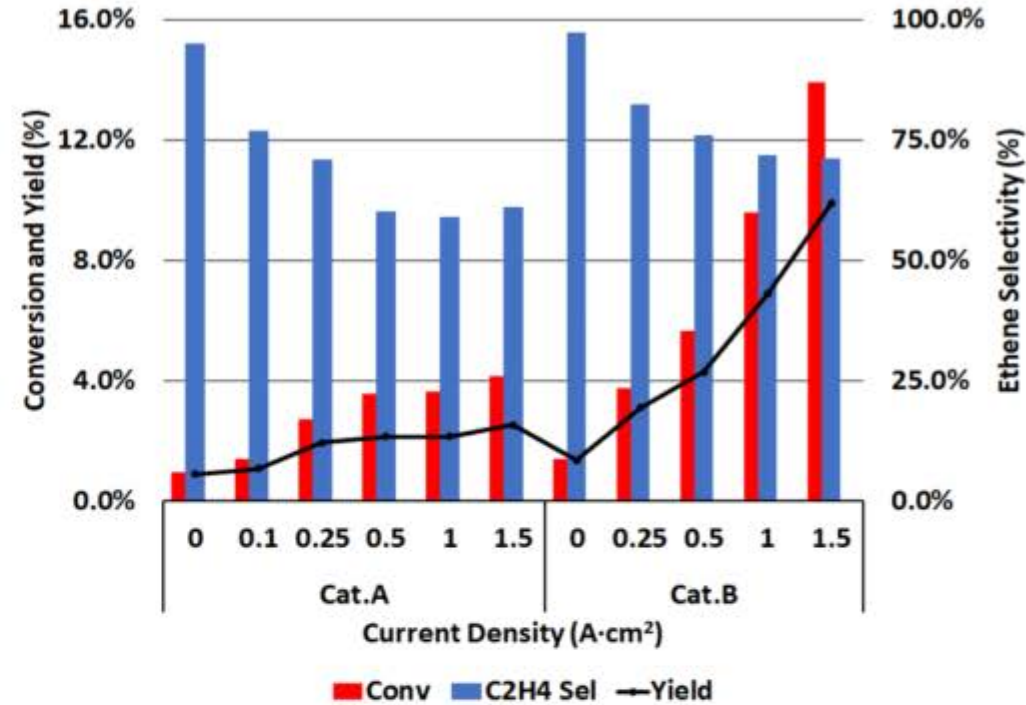
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Preliminary e-ODH Results
for Select Electrocatalysts
with Ethane at 700 °C

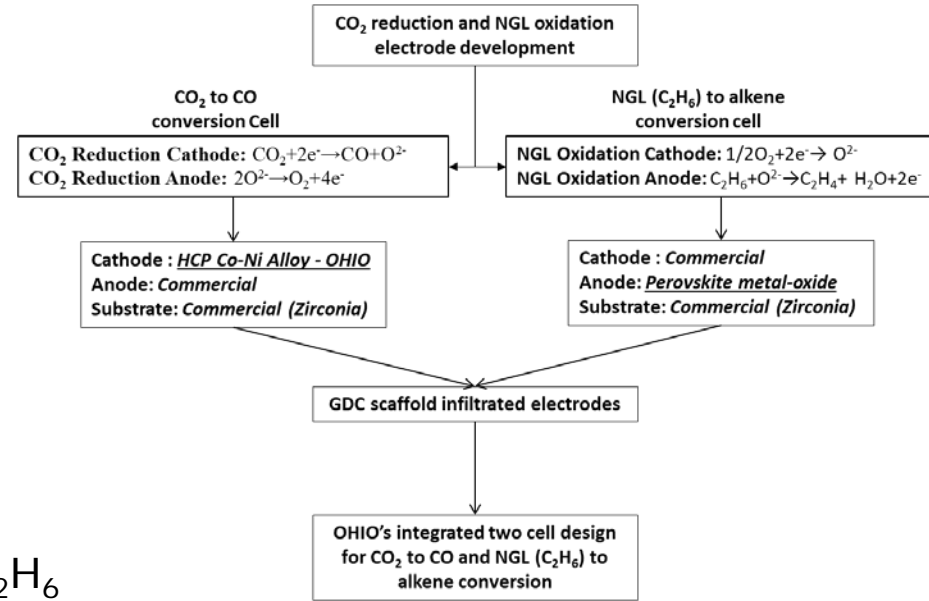
Technical Approach

Project Schedule

- Cathode: Demonstrate CO₂ reduction with Faradaic efficiency $\geq 90\%$ (Sept. 2020)
- Anode: Demonstrate e-ODH catalyst with $S_{C_2H_4} \geq 80\%$ (Dec. 2020)

Key Project Success Criteria

- Cathode
 - Faradaic Efficiency: $\geq 90\%$
- Anode:
 - $S_{C_2H_4}$: 73-89% for WNG w/ 20-35% C₂H₆
- Process
 - Product Cost: <\$23.75/MMBtu
 - GHG Emissions: <50% vs. conventional methods



Catalyst and Electrode Development Plan for CO₂ Electrolysis and NGL Oxidation