Project Overview [DE-FE0031709]

Overall Project Objectives
- Develop solid oxide electrolysis process for simultaneous conversion of CO$_2$ 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 CO$_2$ 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

CO₂/WNG SOEC
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DFT Analyses for CO₂ Electrolysis [1]

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Preliminary CO$_2$ Electrolysis Results at 750 °C w/ Ni electrode
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Preliminary e-ODH Results for Select Electrocatalysts with Ethane at 700 °C
Technical Approach

Project Schedule

- Cathode: Demonstrate CO\textsubscript{2} reduction with Faradaic efficiency ≥90% (Sept. 2020)
- Anode: Demonstrate e-ODH catalyst with \( S_{\text{C}_2\text{H}_4} \) ≥80% (Dec. 2020)

Key Project Success Criteria

- Cathode
  - Faradaic Efficiency: ≥90%
- Anode:
  - \( S_{\text{C}_2\text{H}_4} \): 73-89% for WNG w/ 20-35% C\textsubscript{2}H\textsubscript{6}
- Process
  - Product Cost: <$23.75/\text{MMBtu}$
  - GHG Emissions: <50% vs. conventional methods

Catalyst and Electrode Development Plan for CO\textsubscript{2} Electrolysis and NGL Oxidation