An Intensified Electro-Catalytic Process for Production of Formic Acid from Power Plant CO_2 Emissions

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http://www.caer.uky.edu/powergen/home.shtml

Project Overview

- Develop and test a novel electro-catalytic method for the production of high-value formic acid from coal-derived CO_2 as a strategy to offset the cost of CO_2 capture.
- The project will involve the development and testing of an engineered catalyst to selectively reduce CO_2 directly and exclusively to formic acid, along with process intensification aspects of the reactor design.

- **Project Period:** 1/1/2019 - 6/30/2021 (30 months)
- **Funding**: Federal - $800K; CS - $201K; Total - $1M

Center for Applied Energy Research

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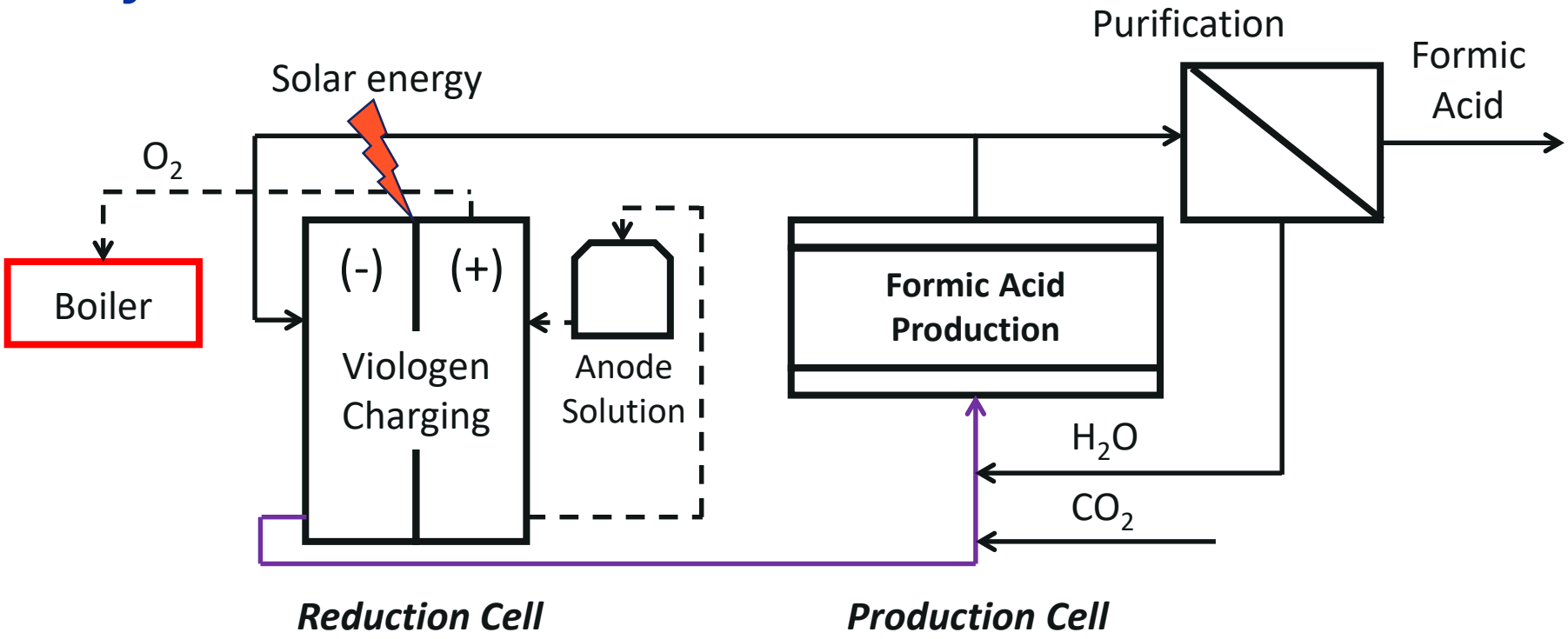
2009

Technology Background

UKy-CAER Andora Process

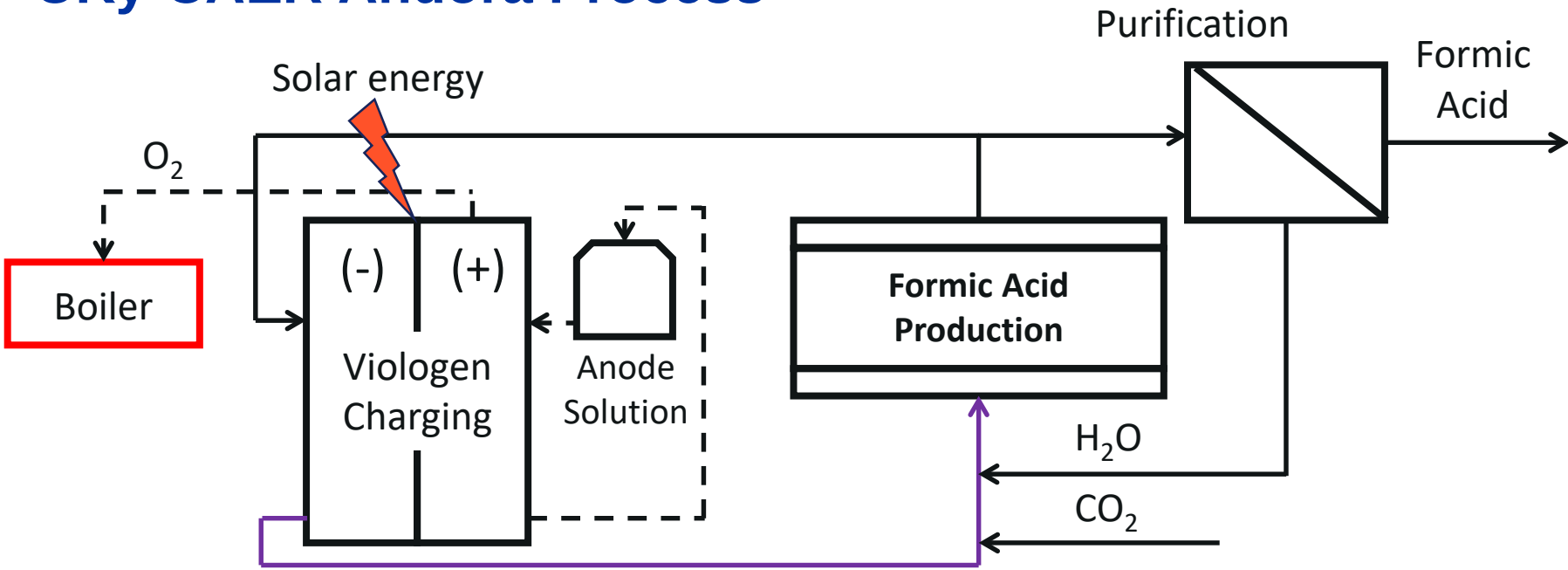


To provide a selective and robust process, the UKy-CAER Andora process focuses on:

1. Use of a charge transfer mediator to limit the cell voltage and degradation pathways of the electrochemical process
2. Separate charging and formic acid production reactors/cells to effectively encapsulate the catalyst and provide a steady stream of formic acid

Technology Background

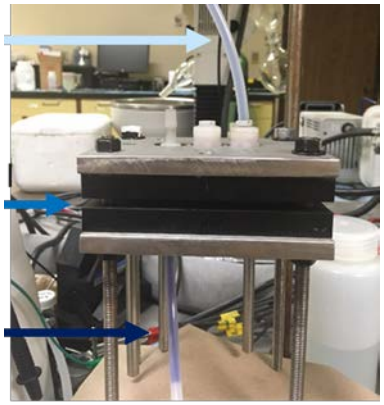
UKy-CAER Andora Process



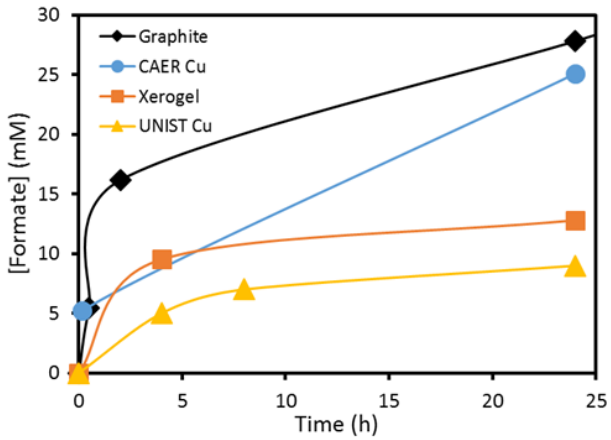
Reduction Cell

Oxidized Methyl Viologen (MV) enters reduction cell;

When MV is reduced it changes from clear to dark blue



Production Cell



Formic acid production of >25 mM achieved using carbon electrodes and the charge carrier in a batch cell reactor with the engineered catalyst

Project Summary

Project Schedule: 1/1/2019 – 6/30/2021 (30 months)		
Task	Timeline	Status/Success Criteria
Technology Maturation Plan	-	Initial TMP competed; will continue to update during project
Development of catalysts	Initial 24 months	Long term stability (less than 25% deactivation) at >100hr of continuous operation and formic acid production
Flow-through reactor design, fabrication and commissioning	Initial 24 months	Electrochemical cell carrier charge efficiency of greater than 60%; Production cell capable of supporting flow rate of 2 mL/min during continuous operation
Lab-scale reactor testing	Initial 24 months	Continuous operation of reduction and production cells with a formic acid production of 25 mM and a selectivity of greater than 80%
Life Cycle and Technical and Economic studies	Final 6 months	Demonstrate the proposed process to be a substantive CO_2 mitigation option

Acknowledgements

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