High-Efficiency, Low-Cost, Additive-Manufactured Air Contactor

Project Number DE-AR0001412

Mike Izenson

Creare LLC

U.S. Department of Energy

National Energy Technology Laboratory

Direct Air Capture Kickoff Meeting

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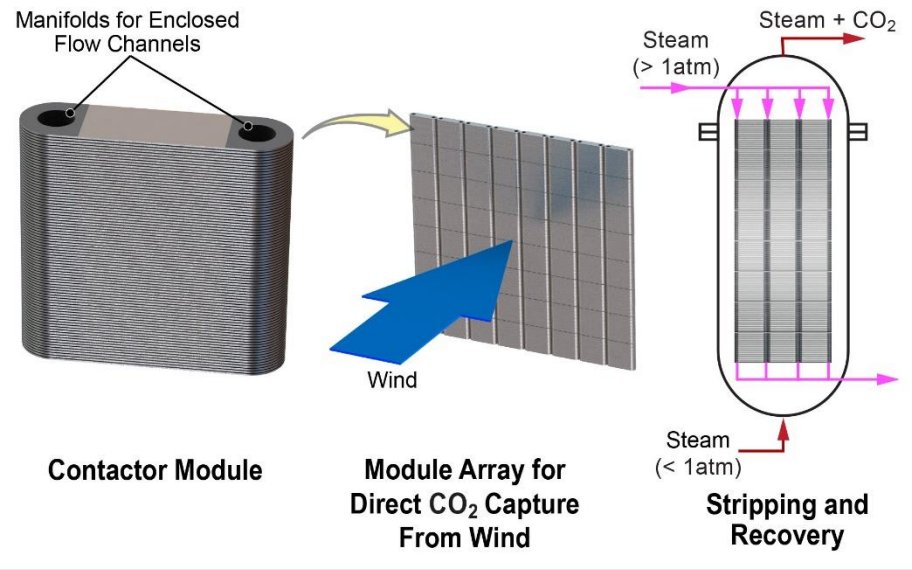
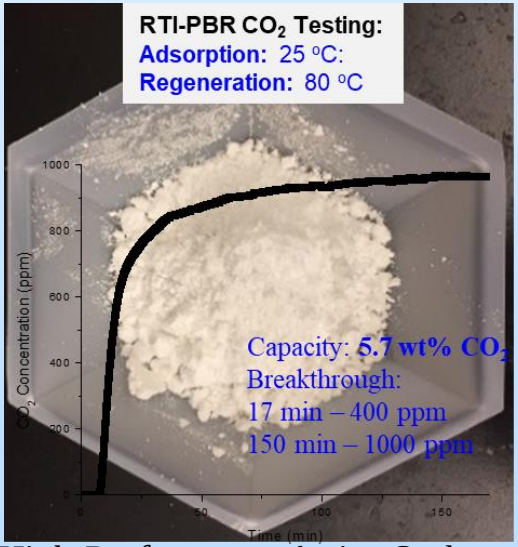
Program Overview

1. Funding: $784K DOE SBIR funding
2. Overall Project Performance Dates
   a. Two-year period of performance
   b. Start date: TBD (currently finalizing contract)
3. Project Participants
   a. Creare LLC: Contactor analysis, design, testing
   b. RTI International (RTI): Sorbent development and preparation
   c. Edare LLC: Contactor fabrication
4. Overall Project Objectives
   a. Demonstrate contactor fabrication
   b. Measure sorption performance
   c. Multi-scale CFD analysis
   d. Concept design for large-scale system
   e. Techno-economic analysis



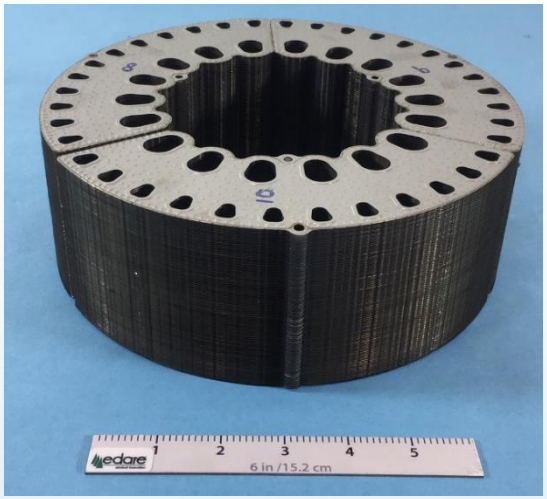
Modular AM Wind-Driven Contactor

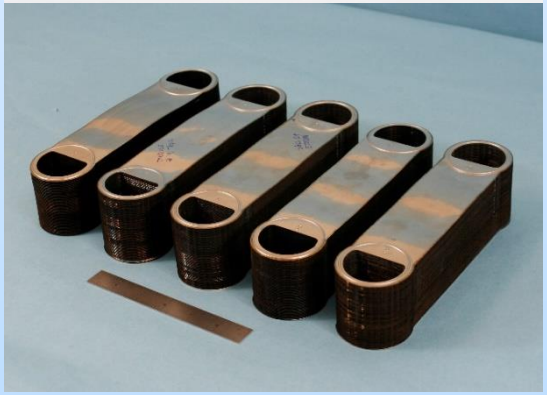


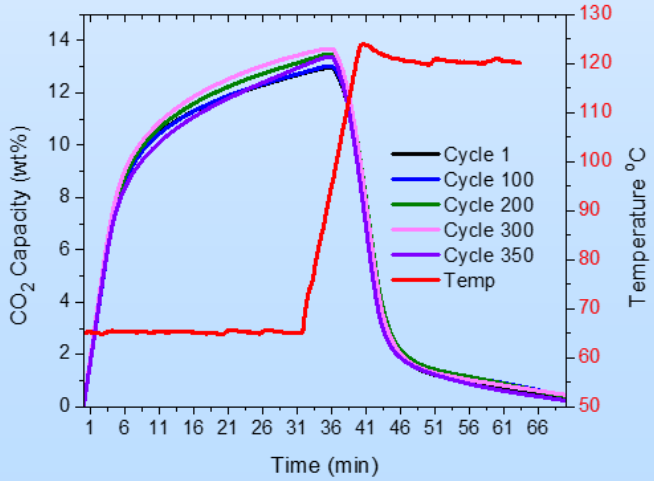
High-Performance Amine Sorbents

Technology Background

1. DAC Concept
   a. Wind driven
   b. Additive-manufactured, modular, high-efficiency contactor
   c. Advanced amine sorbent coatings from RTI
2. Supporting Data
   a. Additive manufacturing for compact heat exchangers
   b. Sorbent performance under flue gas conditions
3. Advantages
   a. Low-cost contactors and sorbents
   b. Optimized for wind-driven operation
4. Challenges
   a. Scale-up
   b. Lifetime qualification

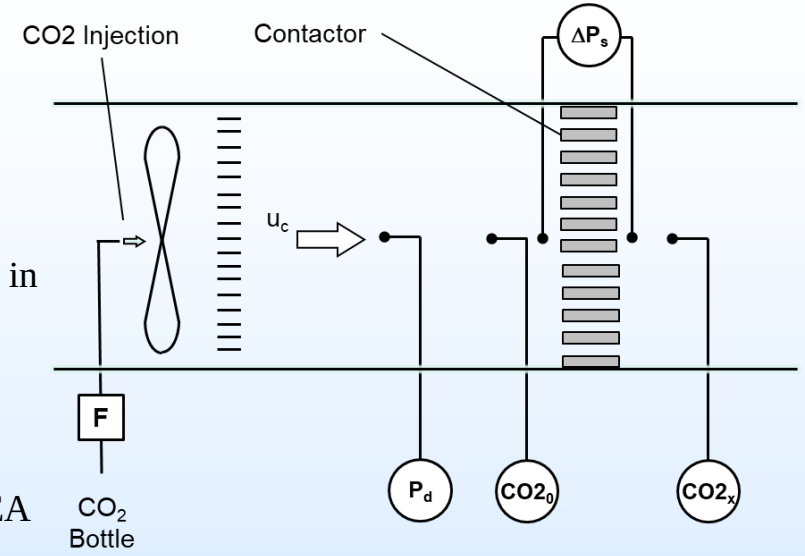


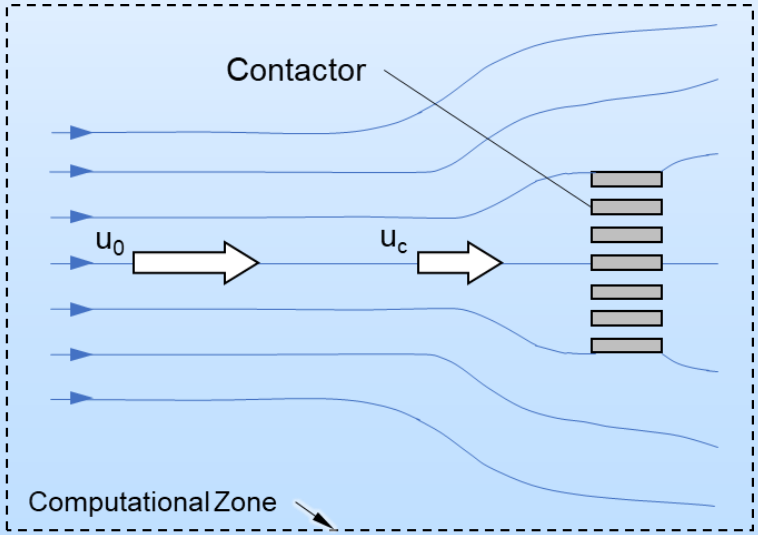


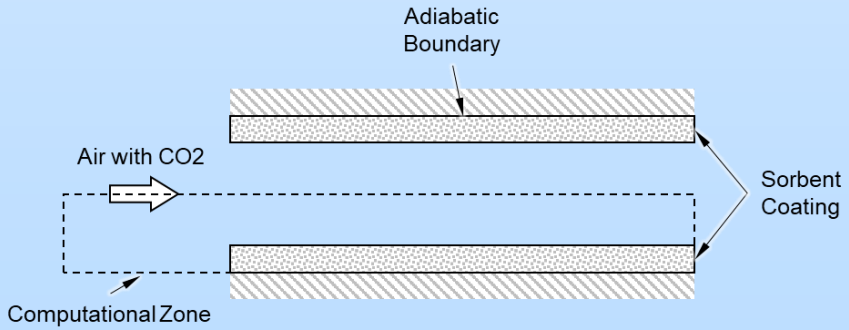


Technical Approach/Project Scope

1. Experimental Design and Work Plan
   a. Produce modular AM metal contactor core
   b. Develop and optimize sorbent coating
   c. Measure performance of contactor modules
   d. Analyze wind-driven installation and sorption processes in single channel using CFD
   e. Perform TEA based on test results and analysis
2. Key Milestones
   a. Phase I: Contactor performance and results of initial TEA
   b. Phase II: Performance and durability testing, large-scale system concept design, final TEA
3. Success Criteria
   a. Sorbent loading and cyclic sorption capacity
   b. Excellent durability for 10 to 100 cycles
   c. Estimated capture cost < \$100 / t CO_2







Team and Facilities

Mike Izenson, Creare

Scott Phillips, Creare

Mustapha Soukri, RTI

Jeff Mecham, RTI

Creare General-Purpose Labs

RTI Lab 288

Progress and Current Status

1. Equipment to be Used/Built in the Project
   a. Contactor core fabrication and assembly facilities (existing)
   b. Contactor module performance test rig
   c. Computational models for wind-driven contactor
   d. Dendrimer sorbent synthesis (existing)
   e. Sorbent coating development and test capabilities
2. Significant Accomplishments and How They Tie to the Technology Challenges
   a. Prior work on modular AM heat exchangers – shows feasibility of low-cost manufacture of high-performance contactors
   b. Prior work on amine sorbents for CO_2 capture from flue gas – shows feasibility of high CO_2 cyclic sorption capacity at low operating temperatures
3. Current Status
   a. Project is just getting started

Opportunities for Collaboration

1. Synergistic Effects
   a. Accelerate large-scale demonstration
   b. Accelerate commercialization
2. Potential Areas of Complementary Work
   a. Scale up manufacturing processes
   b. Scale-up of CO_2 capture demonstrations