UCLA Samueli School of Engineering | LC2 Susteon | U.S. DEPARTMENT OF ENERGY | NETL NATIONAL ENERGY TECHNOLOGY LABORATORY

Project Manager: Andrew Jones
Agreement #: FE0031718

Project Overview: A Scalable Process for Upcycling Carbon Dioxide (CO_2) and Coal Combustion Residues into Construction Products

Overall Project Performance Dates: 1/1/2019 - 12/31/2020

Project Participants: UCLA; Susteon Inc.

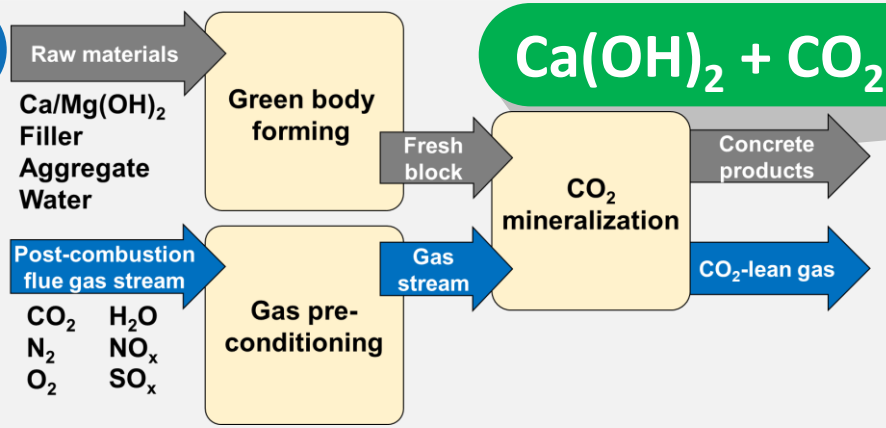
Project Funding Profile (20.31% Cost Share)		
	Gov't Share	Cost Share
UCLA	$1,200,000	$382,265
Susteon Inc.	$300,000	$0
Total ($)	$1,500,000	$382,265

Overall Project Objectives:

- ***Upcycle industrial wastes and CO_2 –*** Produce low-carbon CO_2Concrete products from coal combustion residues, flue gas CO_2, and low-grade waste heat
- ***System design –*** Produce data supporting heat and mass balances for design of a "bolt-on" CO_2 mineralization system at coal-fired power plants
- ***Field test CO_2 processing system –*** Fabricate and field test a CO_2 mineralization system to consume about 100 kg of CO_2 per day from coal-fired flue gas

Technology Background: Low-carbon cementation by CO_2 mineralization

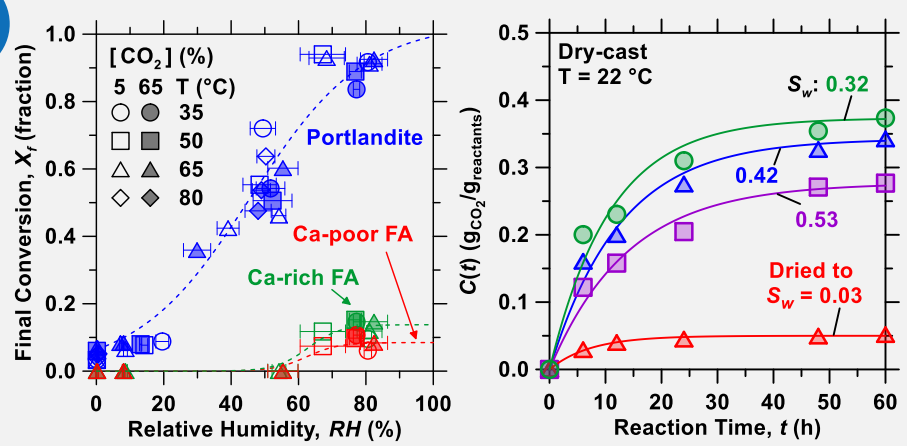
1



$$Ca(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$$

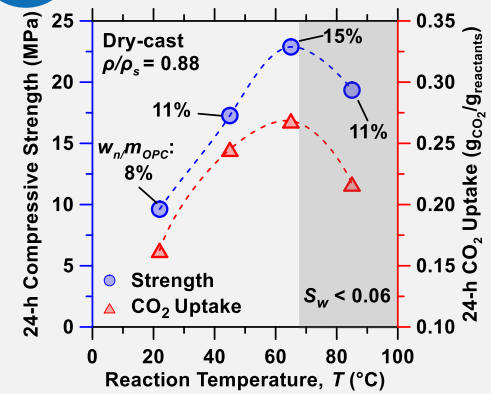
Concrete masonry units

2



CO_2 mineralization kinetics

3



Compressive strength

4

Demonstration of *alpha* prototype system

Preliminary LCA:

~ 65 % CO_2 emissions reduction relative to conventional CMU

Technical Approach/Project Scope: Experimentation, system design, fabrication, and field tests

- **Experimental design and work plan:** Acquiring bench-scale data describing CO_2 mineralization reaction and product performance in relation to composition and processing (temperature, relative humidity, flow rates)
- Process design informed by data → system design and fabrication → field testing at host site → analysis/scaling

Key project milestones

9/30/19	12/26/19	6/23/20	9/21/20	12/31/20	12/31/20
Completed bench-scale experiments for design inputs	Completed process design and bid specification	System fabricated and FATs passed	System installed and commissioned at host site	Completed field testing of CO_2Concrete system at host site	Completed design scaling, techno-economic analysis, and lifecycle analysis

Key project success criteria (at project completion):

- CO_2Concrete formulations demonstrate CO_2 uptake between 0.05 to 0.50 g CO_2/ g reactant and compressive strength > 13.8 MPa for hollow-core block applications
- Field testing demonstrates 50 to 90 % CO_2 utilization efficiency using real flue gas at host site
- CO_2Concrete produced has a lifecycle footprint that is > 25 % smaller than OPC concrete of equal performance