FROM CAPTURED CO_2 TO VALUE-ADDED CHEMICALS: A PHOTOCHEMICAL APPROACH

Project Number: FWP #34698

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U.S. Department of Energy

National Energy Technology Laboratory

Direct Air Capture Kickoff Meeting

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Program Overview

a. Funding (DOE and Cost Share)

DOE: $4.5M Cost Share: $0

b. Overall Project Performance Dates:

Oct 1, 2020 – Sep 20, 2023

c. Project Participants

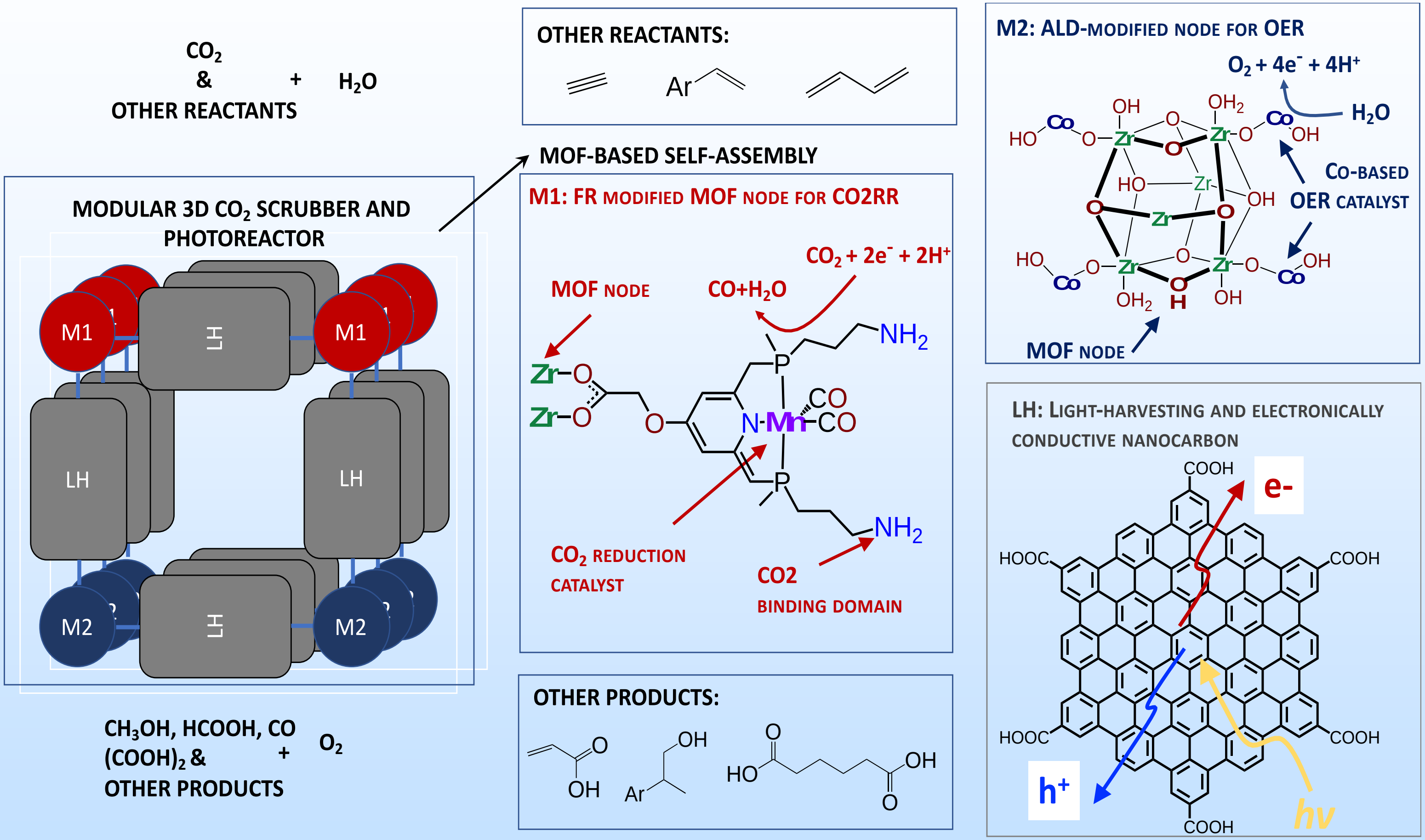
ANL: Chen, Glusac, Kaphan, Martinson, Mulfort, Tiede, Zapol

SLAC: Cordones-Hahn

d. Overall Project Objectives

Photoreactive capture that combines DAC of CO_2 with its direct conversion into fuels or value-added chemicals using visible light as an energy input.

Technology Background



Chromophores, catalysts and capture groups combined in MOFs.

CO_2 release step avoided.

Technical Approach/Project Scope

a. Experimental design and work plan

Molecular Photoreactor Synthesis (Glusac, Martinson, Mulfort)

DAC and Photocatalysis (Glusac, Kaphan and Zapol)

Mechanisms (Chen, Cordones-Hahn, Glusac, Tiede and Zapol)

b. Project schedule – just provide key milestones; do not include a detailed Gantt chart

Year 1: synthesis of functionalized MOFs & catalyst discovery

Year 2: light-harvesting/charge separation studies & DAC screening

Year 3: proof-of-principle demonstration of photo-reactive capture

c. Project success criteria

Demonstration of photo-reactive CO_2 capture

Mechanistic understanding of key steps of photoreactive capture

Identification of pathways toward improved systems

Team and Facilities

a. Photos of the team, including collaborators


Chen


Cordones Hahn


Glusac


Kaphan


Martinson

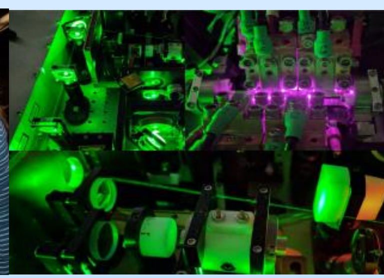

Mulfort


Tiede


Zapol

b. Photos of facilities or specialized equipment


High-Throughput Research Lab


Laser Spectroscopy Labs


APS


SLAC

Computer Clusters

Progress and Current Status of Project

a. Description of the test equipment used/built in the project

   high throughput experimental setup (chemical and photochemical)

   Femtosecond transient reflectance

b. Significant accomplishments and how they tie to the technology challenges

   synthesis and scale-up of the first type of MOF crystals. This will enable future work with catalyst deposition.

c. Performance achieved so far when compared to project goals and how the performance relates to the economic and technical advantages

   On track.

Opportunities for Collaboration

a. Discuss how collaboration could have a synergistic effect on advancing the technologies described during the session

   Combining capture and conversion

   Use of sunlight as an energy input

b. List potential areas of complementary work that others may contribute to this technology, including analysis, fabrication, modeling, engineering design, scale-up, etc.

   Engineering efforts to make a functional material.

   Scale-up from mg quantities.