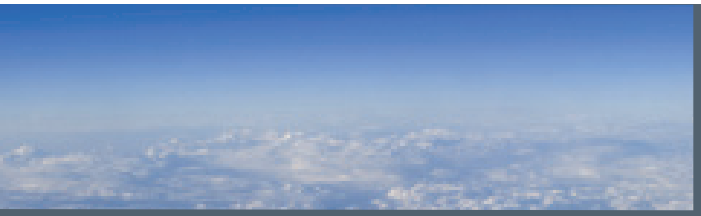

"Creating new materials developed specifically for capturing CO_2 while developing more cost-effective and energy-efficient processes would enable widespread implementation of carbon capture systems, improve our environment, and position the U.S. as a leader in this growing global industry."

- ARPA-E IMPACCT

Cover image provided by the Global Carbon Project

The Team

ASU LightWorks

Chemical and electrochemical expertise and systems and economic modeling.

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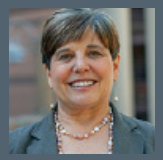

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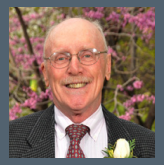
Cell design and fabrication

Kathy Ayers

Andy Roemer

University of Colorado

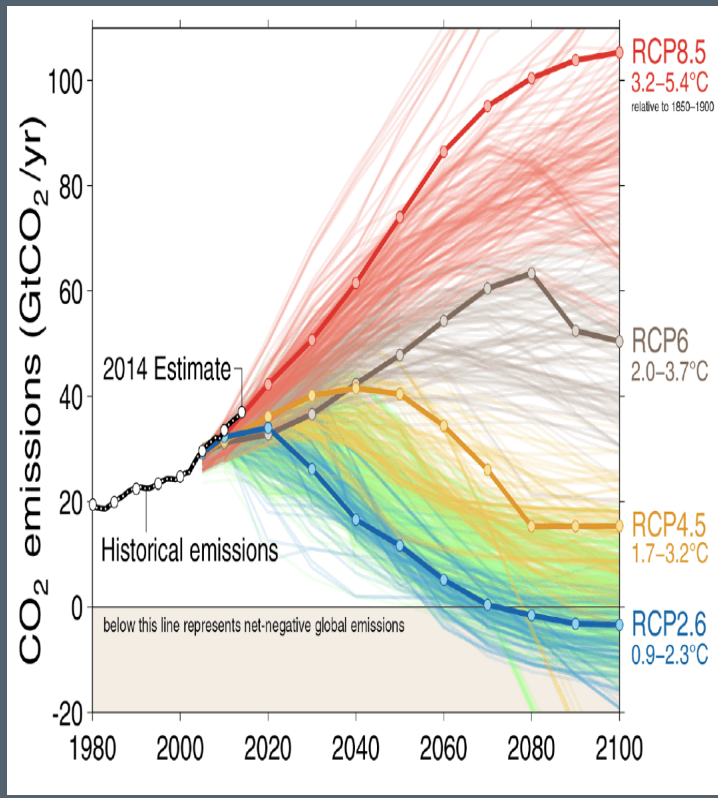
Membrane synthesis and formulation



Richard Noble

Douglas Gin

Carbon capture and storage



Energy efficient electrochemical capture and release of carbon dioxide

ASU LightWorks
ARIZONA STATE UNIVERSITY

LightWorks is an Arizona State University initiative that inspires and develops ways to revolutionize the use of energy and the large scale conversion of sunlight, carbon dioxide and water into useful products. We support creation of new industries not just to power the world, but to empower it; not just to create wealth for a few, but to enrich people's lives everywhere; not just to light an energy revolution, but to enlighten communities across the globe; not just to achieve energy security but to secure energy justice.
www.asulightworks.com

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$$P + 2e^- \longleftrightarrow 2N^- \quad \text{Reduction at the cathode}$$
$$N^- + CO_2 \longleftrightarrow [N\text{-}CO_2]^- \quad CO_2 \text{ Capture}$$
$$2[N\text{-}CO_2]^- \longleftrightarrow P + 2CO_2 + 2e^- \quad \text{Oxidation at the anode}$$

WHAT

A team of researchers led by Arizona State University are developing a reliable and energy efficient carbon dioxide capture system to mitigate waste carbon dioxide emissions. This innovative device uses less energy than commercial carbon capture systems and easily retrofits at existing facilities.

HOW

This carbon capture device employs an electrochemical cell to capture CO2 at the cathode, transport it across the cell and release it at the anode.

KEY INNOVATIONS

- Uses an electrochemical assist based on novel chemistry
- Not oxygen sensitive
- Runs on electricity
- Able to transport up concentration and pressure gradients
- Continuous operation based on fuel cell gas diffusion electrodes
- Low capital cost

Project Update

The project team remains focused on systematically tackling performance challenges and de-risking failure modes that would limit ultimate commercial viability.

Through innovative chemistry, the team successfully:

- Developed several new membrane formulation strategies
- Identified more stable electrolyte materials for more robust, long term operation

Cell design and operation:

- Developed a new flow cell design that enables higher capture rates
- Cathode reaction: precursor reduction produces a nucleophile that captures CO2 creating an adduct
- Anode reaction: adduct oxidation releases the CO2 regenerating the precursor