

New process more efficiently recycles excess carbon dioxide into fuel, study finds

January 11 2021



Credit: CC0 Public Domain

For years, researchers have worked to repurpose excess atmospheric carbon dioxide into new chemicals, fuels and other products traditionally made from hydrocarbons harvested from fossil fuels. The recent push to

mitigate the climactic effects of greenhouse gases in the atmosphere has chemists on their toes to find the most efficient means possible. A new study introduces an electrochemical reaction, enhanced by polymers, to improve CO₂-to-ethylene conversion efficiency over previous attempts.

The results of the study led by University of Illinois Urbana-Champaign chemistry professor Andrew Gewirth and graduate student Xinyi (Stephanie) Chen are published in the journal *Natural Catalysis*.

Allowing CO₂ gas to flow through a reaction chamber fitted with copper electrodes and an [electrolyte solution](#) is the most common method researchers use to convert CO₂ to useful carbon-containing chemicals, the study reports.

"Copper metal is highly selective toward the type of carbon that forms ethylene," Gewirth said. "Different electrode materials will produce different chemicals like carbon monoxide instead of ethylene, or a mix of other carbon chemicals. What we have done in this study is to design a new kind of copper electrode that produces almost entirely ethylene."

Previous studies have used other metals and molecular coatings on the electrode to help direct the CO₂-reduction reactions, the study reports. However, these coatings are not stable, often break down during the reaction process and fall away from the electrodes. "What we did differently in this study was to combine the copper ions and polymers into a solution, then apply that solution to an [electrode](#), entraining the polymer into the [copper](#)," Chen said.

In the lab, the team found that the new polymer-entrained electrodes were less likely to break down and produced more stable chemical intermediates, resulting in more efficient ethylene production. "We were able to convert CO₂ to ethylene at a rate of up to 87%, depending on the electrolyte used," Chen said. "That is up from previous reports of

conversion rates of about 80% using other types of electrodes."

"With the development of economic sources of electricity, combined with the increased interest in CO₂-reduction technology, we see great potential for commercialization of this process," Gewirth said.

More information: Xinyi Chen et al, Electrochemical CO₂-to-ethylene conversion on polyamine-incorporated Cu electrodes, *Nature Catalysis* (2020). [DOI: 10.1038/s41929-020-00547-0](https://doi.org/10.1038/s41929-020-00547-0)

Provided by University of Illinois at Urbana-Champaign

Citation: New process more efficiently recycles excess carbon dioxide into fuel, study finds (2021, January 11) retrieved 17 April 2024 from <https://phys.org/news/2021-01-efficiently-recycles-excess-carbon-dioxide.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.