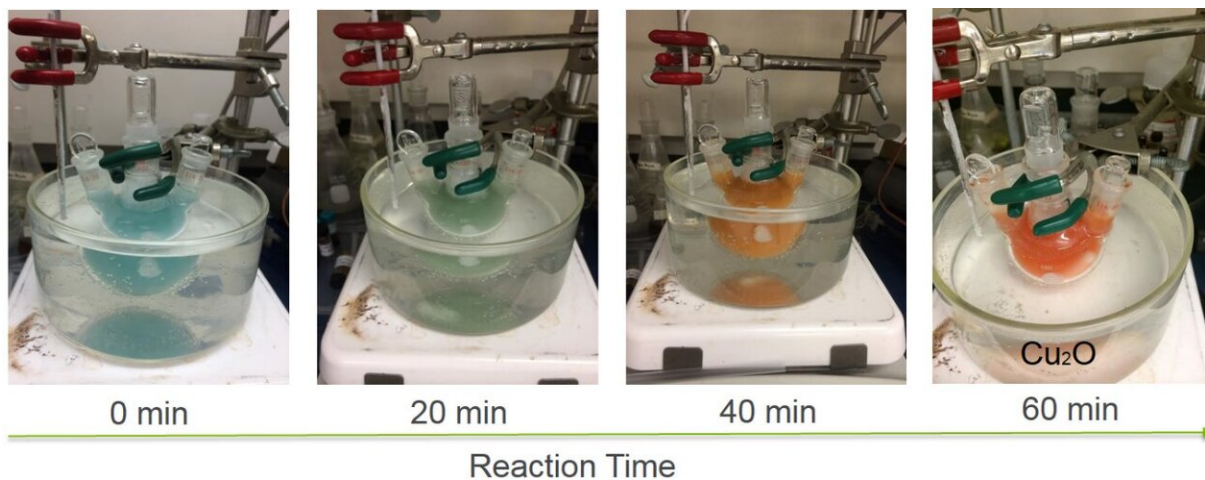


# Scientists create 'artificial leaf' that turns carbon into fuel

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An hour-long chemical reaction creates the engineered red powder that is the key to new technology to turn carbon dioxide into fuel. Credit: University of Waterloo

Scientists have created an "artificial leaf" to fight climate change by inexpensively converting harmful carbon dioxide ( $\text{CO}_2$ ) into a useful alternative fuel.

The new technology, outlined in a paper published today in the journal *Nature Energy*, was inspired by the way plants use energy from sunlight to turn [carbon dioxide](#) into food.

"We call it an [artificial leaf](#) because it mimics real leaves and the process of photosynthesis," said Yimin Wu, an engineering professor at the University of Waterloo who led the research. "A leaf produces glucose and oxygen. We produce methanol and oxygen."

Making methanol from carbon dioxide, the primary contributor to [global warming](#), would both reduce [greenhouse gas emissions](#) and provide a substitute for the fossil fuels that create them.

The key to the process is a cheap, optimized red powder called cuprous oxide.

Engineered to have as many eight-sided particles as possible, the powder is created by a chemical reaction when four substances—glucose, copper acetate, [sodium hydroxide](#) and sodium dodecyl sulfate—are added to water that has been heated to a particular temperature.

The powder then serves as the catalyst, or trigger, for another chemical reaction when it is mixed with water into which carbon dioxide is blown and a beam of white light is directed with a solar simulator.

"This is the chemical reaction that we discovered," said Wu, who has worked on the project since 2015. "Nobody has done this before."

The reaction produces oxygen, as in photosynthesis, while also converting carbon dioxide in the water-powder solution into methanol. The methanol is collected as it evaporates when the solution is heated.

Next steps in the research include increasing the methanol yield and commercializing the patented process to convert carbon dioxide collected from major greenhouse gas sources such as power plants, vehicles and oil drilling.

"I'm extremely excited about the potential of this discovery to change the game," said Wu, a professor of mechanical and mechatronics engineering, and a member of the Waterloo Institute for Nanotechnology. "Climate change is an urgent problem and we can help reduce CO<sub>2</sub> emissions while also creating an alternative fuel."

Wu collaborated on the paper, Facet-dependent active sites of a single Cu<sub>2</sub>O particle photocatalyst for CO<sub>2</sub> reduction to methanol, with Tijana Rajh and other researchers at the Argonne National Laboratory in Illinois, as well as scientists at California State University, Northridge, and the City University of Hong Kong.

**More information:** Facet-dependent active sites of a single Cu<sub>2</sub>O particle photocatalyst for CO<sub>2</sub> reduction to methanol, *Nature Energy* (2019). [DOI: 10.1038/s41560-019-0490-3](https://doi.org/10.1038/s41560-019-0490-3) , [nature.com/articles/s41560-019-0490-3](https://www.nature.com/articles/s41560-019-0490-3)

Provided by University of Waterloo

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