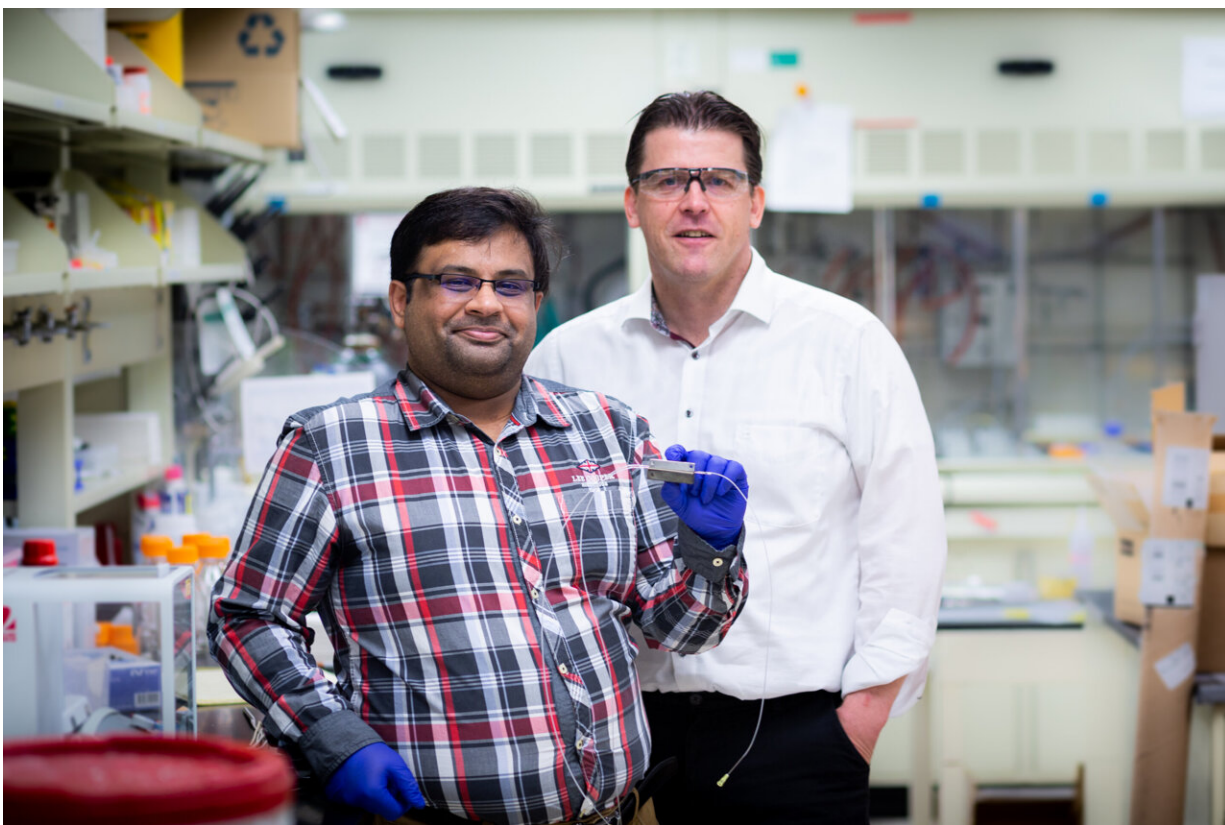


Scientists intensify electrolysis, utilize carbon dioxide more efficiently with magnets

June 30 2021



Chemical and biomolecular engineering professor and department head Paul Kenis (right) and graduate student Saket Bhargava (left) report reducing the energy required for CO₂ electrolysis by more than 60% in a flow electrolyzer using magnetism. Credit: University of Illinois/Claire Benjamin

For decades, researchers have been working toward mitigating excess

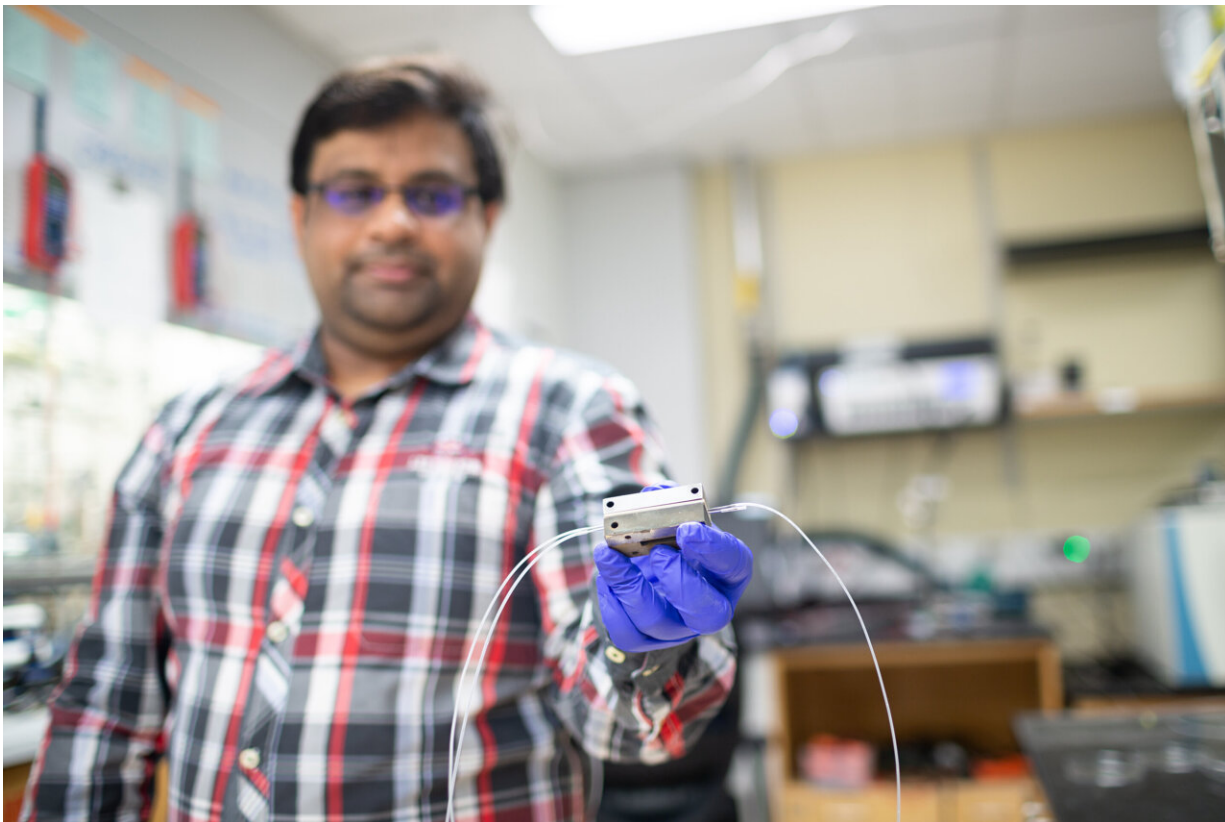
atmospheric carbon dioxide (CO₂) emissions. One promising approach captures atmospheric CO₂ and then, through CO₂ electrolysis, converts it into value-added chemicals and intermediates—like ethanol, ethylene, and other useful chemicals. While significant research has been devoted to improving the rate and selectivity of CO₂ electrolysis, reducing the energy consumption of this high-power process has been underexplored.

In *ACS Energy Letters*, researchers from the University of Illinois Urbana-Champaign report a new opportunity to use magnetism to reduce the [energy](#) required for CO₂ electrolysis by up to 60% in a flow electrolyzer.

In a typical CO₂ flow electrolyzer, electricity is supplied to drive the reactions at the cathode (where [carbon dioxide](#) is reduced into useful byproducts) and the anode (where water is oxidized, producing oxygen).

Most studies have focused on making the reduction reaction at the cathode more efficient at higher rates; however, this process requires little energy compared to the oxidation reaction on the anode—which often accounts for more than 80% of the energy required for CO₂ electrolysis, and therefore, offers the most room for improvement.

"The answer was staring us right in the face—of course, the trick is to reduce the energy consumption at the anode," said first-author Saket S. Bhargava, a graduate student in chemical and biomolecular engineering at Illinois. "We decided that if oxygen evolution is the problem, why not use a magnetic field at the oxygen evolving electrode and see what happens to the entire system."



Chemical and biomolecular engineering graduate student Saket Bhargava holds a flow electrolysis cell. Credit: University of Illinois/Claire Benjamin

They used a [magnetic field](#) at the anode to achieve energy savings ranging from 7% to 64% by enhancing mass transport to/from the electrode. They also swapped the traditional iridium catalyst—a precious metal—with a nickel-iron catalyst comprised of abundant elements.

"Our ultimate goal is to transform carbon dioxide back into carbon-based chemicals," said lead author Paul Kenis, a chemical and biomolecular engineering professor and department head at Illinois. "With this study, we have demonstrated how further to reduce the significant energy requirements for CO₂ [electrolysis](#), hopefully making this process more viable for adoption by industry."

More information: Saket S. Bhargava et al, Decreasing the Energy Consumption of the CO₂ Electrolysis Process Using a Magnetic Field, *ACS Energy Letters* (2021). [DOI: 10.1021/acseenergylett.1c01029](https://doi.org/10.1021/acseenergylett.1c01029)

Provided by University of Illinois at Urbana-Champaign

Citation: Scientists intensify electrolysis, utilize carbon dioxide more efficiently with magnets (2021, June 30) retrieved 3 May 2024 from <https://techxplore.com/news/2021-06-scientists-electrolysis-carbon-dioxide-efficiently.html>

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