Cost-effective catalyst converts CO2 into natural gas

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A discovery made in Leiden helps not only to make natural gas from CO2 but also to store renewable energy. Research by Professor Marc Koper and PhD student Jing Shen shows how this process can be implemented in a cost-effective and controllable way.

The conversion of the greenhouse gas CO2 into natural gas is achieved using a chemical process in which CO2 is bubbled through an acid solution. The solution contains a graphite electrode – to which a small negative voltage is applied – with a cobalt-porphyrin catalyst attached to it. It was already known that this catalyst can convert CO2 into carbon monoxide and methane, but the reaction always released unwanted hydrogen. In their investigation, Koper and Shen show for the first time how the process works. They therefore know exactly what the best acidity degree is in order to minimise the amount of hydrogen and to convert as much CO2 as possible into natural gas.

Common materials

An added benefit is that the catalyst is entirely made up of common materials. Cobalt porphyrin is a part of vitamin B12, while the graphite for the electrode is similar to a pencil lead. Therefore the catalyst only costs a few euros. Comparable methods of converting CO2 into methane often use rare and expensive metals, such as platinum.

Realising a dream

Koper hopes that this discovery will bring his dream a little closer to realisation: to convert CO2 and water, the by-products of fuels, into new energy or building blocks for the chemical industry. If this can be achieved using solar energy, this process will also offer a method of storing renewable energy.

Using renewable energy efficiently

'We're generating more and more electricity using solar panels and windmills, but that energy is by no means always used straight away,' Koper explains. 'In Germany, for example, too much renewable electricity is generated sometimes, so you want to store it. That is the most important potential application of our research: to use renewable energy efficiently by converting water and CO2 into valuable products.'

A fundamentally different way

Still, Koper thinks that it will take a while to get to that point. 'This is something for the long term and it could be another fifty years before we have a method that makes valuable products and is also robust, scalable and cost-effective. But I'm nevertheless convinced that this is the way to go. It will not be easy, but this discovery is helpful. We have to find a fundamentally different way to manage energy, and our discovery can contribute to that.'

More information: "Electrocatalytic reduction of carbon dioxide to carbon monoxide and methane at an immobilized cobalt protoporphyrin." *Nature Communications* 6, Article number: 8177 DOI: 10.1038/ncomms9177

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