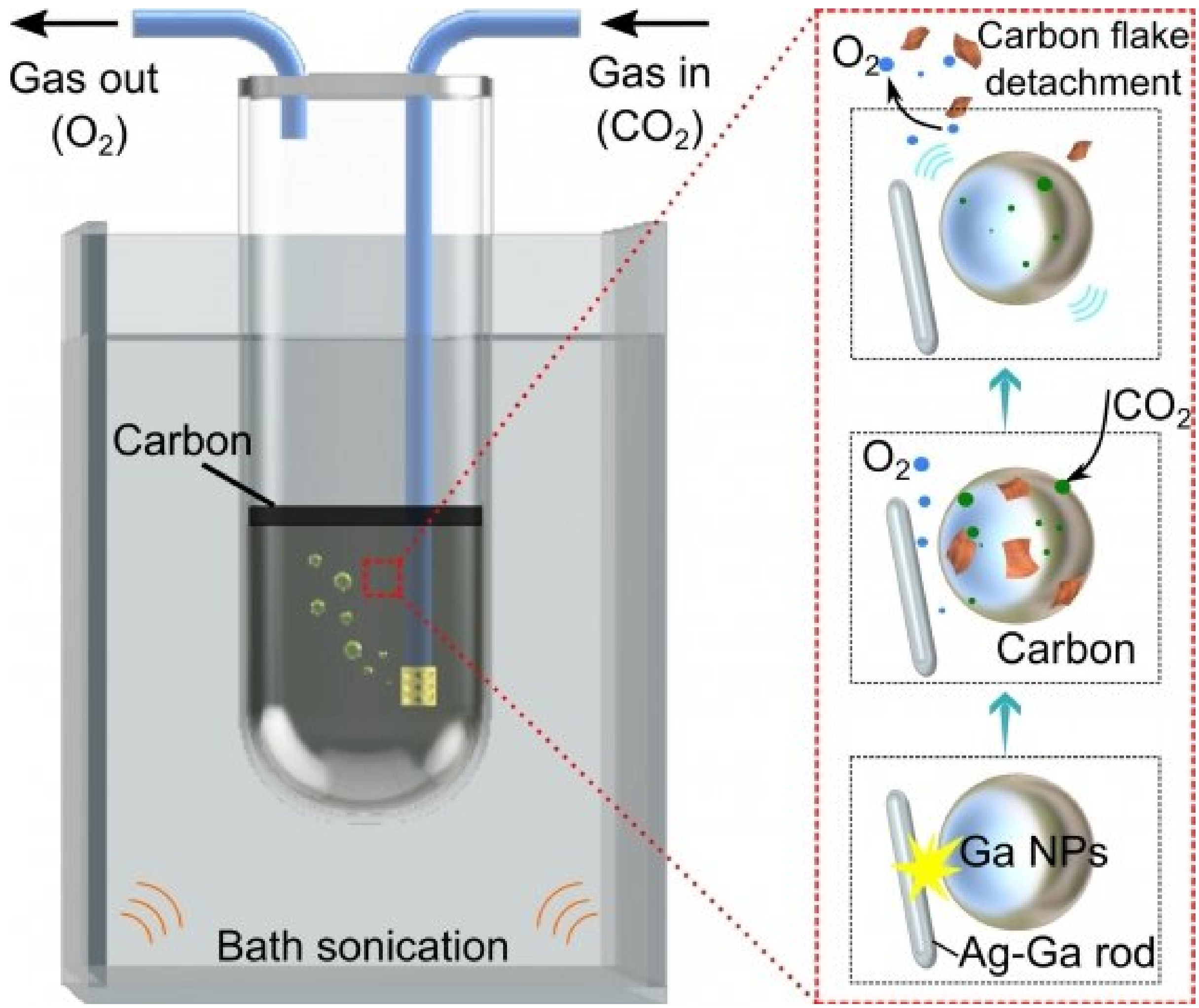
Liquid metal proven to be cheap and efficient CO2 converter

October 13 2021, by Neil Martin



UNSW researchers have helped show how carbon dioxide can be broken down cheaply and efficiently via a process that dissolves captured CO2 gas into a solvent around nanoparticles of gallium. Credit: University of New South Wales

A global collaboration, led by researchers from UNSW, has shown how liquid gallium can be used to help achieve the important goal of net zero carbon emissions.

Engineers from UNSW have helped to discover a cheap new way to capture and convert CO_2 greenhouse emissions using liquid metal.

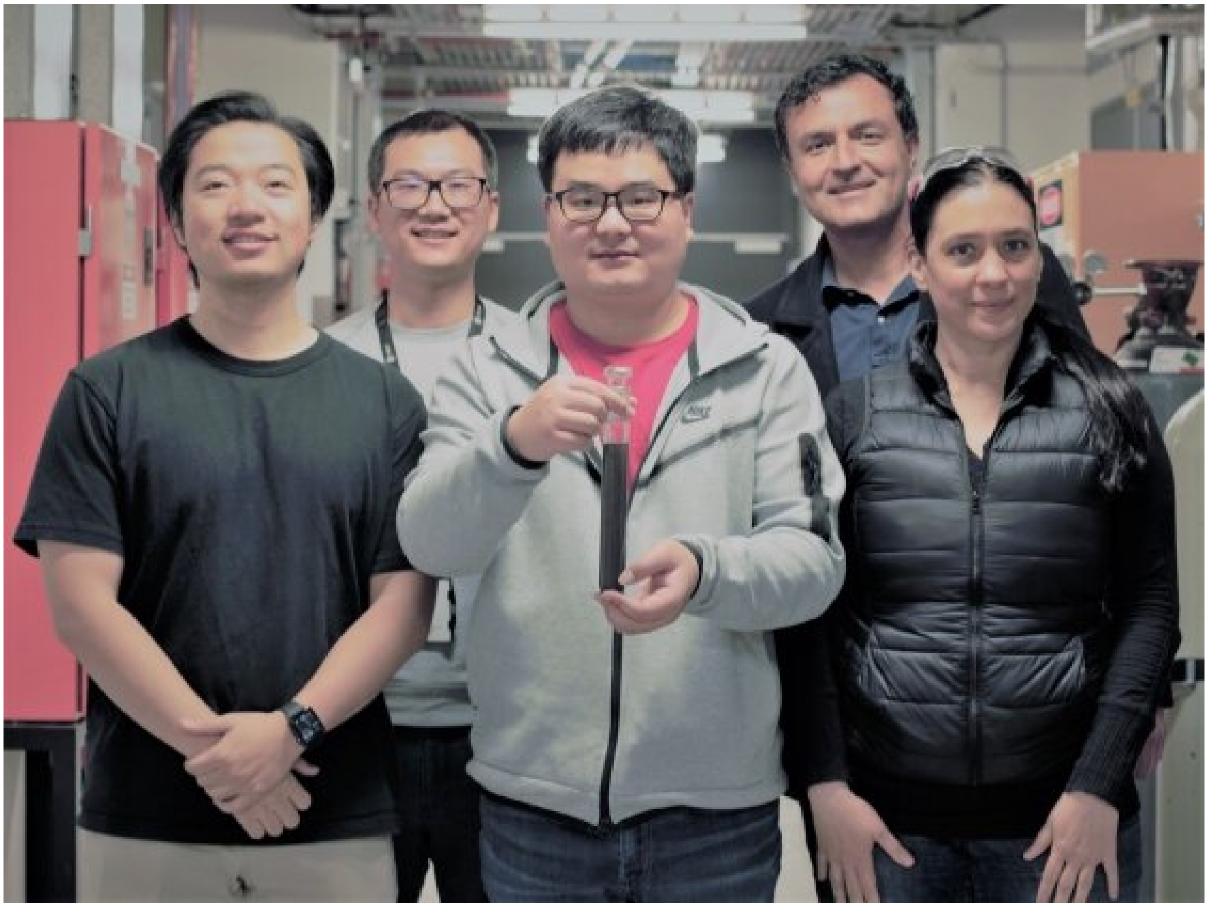
The process can be done at room temperature and uses liquid gallium to convert the carbon dioxide into oxygen and a high-value solid carbon product that can later be used in batteries, or in construction, or aircraft manufacturing.

A team from the School of Chemical Engineering, led by Professor Kourosh Kalantar-Zadeh, worked in collaboration with researchers at University of California, Los Angeles (UCLA), North Carolina State University, RMIT, University of Melbourne, Queensland University of Technology, and the Australian Synchrotron (ANSTO).

Their findings have been published in the *Advanced Materials* journal and Professor Kalantar-Zadeh and his team say the new technology has the potential to be used in a wide variety of ways to significantly reduce the levels of greenhouse gases in the atmosphere.

"We see very strong industrial applications with regards to decarbonisation. This technology offers an unprecedent process for capturing and converting CO_2 at an exceptionally competitive cost," said Junma Tang, the first author of the paper.

"The applications could be in cars to convert polluting exhaust gases, or even at a much larger scale at industrial sites where CO_2 emissions could be immediately captured and processed using this technology.



A selection of the UNSW research team who helped prove liquid gallium can be used to break down carbon dioxide gas. Back row: Jianbo Tang, Professor Kourosh Kalantar-Zadeh. Front row: Zhenbang Cao, Junma Tang, Claudia A. Echeverria. Credit: University of New South Wales

"We have already scaled this system up to two-and-a-half liters dimensions, which can deal with around 0.1 liter of CO_2 per minute. And we've tested that running continuously for a whole month and the efficiency of the system did not degrade."

The newly discovered process dissolves captured CO_2 gas into a solvent around nanoparticles of gallium, which exist in liquid state above 30°C.

The reactor also contains nano-sized solid silver rods that are the key to generating the triboelectrochemical reactions that take place once mechanical energy (e.g. stirring/mixing) is introduced.

A triboelectrochemical reaction occurs in solid–liquid interfaces due to friction between the two surfaces, with an electric field also created that sparks a chemical reaction.

The reactions break the carbon dioxide into oxygen gas, as well as carbonaceous sheets which 'float' to the surface of the container due to differences in density and can therefore be easily extracted.

In their paper, the research team show a 92 percent efficiency in converting a ton of CO_2 as described, using just 230kWh of energy. They estimate this equates to a cost of around $100 per ton of CO_2.

In order to commercialize the research, a spin-out company called LM Plus has been established with the support of UNSW's Knowledge Exchange—a program that helps transform research discoveries into successful innovations to benefit society, along with seed investment from Uniseed.

More information: Junma Tang et al, Liquid metal-enabled Mechanical energy-induced CO2 Conversion, *Advanced Materials* (2021). DOI: 10.1002/adma.202105789

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