PRESS RELEASE

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Subject line: Scientists achieve direct electrocatalytic reduction of CO_2, raising hopes for smart carbon capture

(Tokyo, November 28) **Chemists at Tokyo Institute of Technology propose an innovative way to achieve carbon capture using a rhenium-based electrocatalytic system that is capable of reducing low-concentration CO_2 (even 1%) with high selectivity and durability, which is a new potential technology to enable direct utilization of CO_2 in exhaust gases from heavy industries.**

Scientists are closer to finding effective ways to reduce CO_2 levels — a vital part of responding to climate change and energy efficiency challenges.

A study led by Osamu Ishitani of the Department of Chemistry, Tokyo Institute of Technology (Tokyo Tech) now demonstrates the advantages of applying electrocatalysis[1] to capture low-concentration CO_2.

In their study published in *Chemical Science*, Ishitani and colleagues including Hiromu Kumagai and Tetsuya Nishikawa drew on decades of work on honing the capabilities of a rhenium-based catalyst, and demonstrated its ability to reduce low-concentration CO_2 in the presence of a chemical called triethanolamine (TEOA).

Compared to many previous studies that have focused on reducing pure CO_2, few have explored how to improve direct capture of low-concentration CO_2 — a topic that warrants further investigation, considering that plants harness low concentrations of CO_2 (about 400 ppm, that is 0.04% of the atmosphere) and exhaust gases from heavy industries typically contain low levels of CO_2 (around 3–13%).

By avoiding the need for additional energy-consuming condensation processes, their strategy, if scaled up, could provide a more viable, environmentally friendly solution to CO_2 capture in many settings.

In a series of experiments (see **Figure 1**) to assess electrocatalytic activity, the researchers found that at a CO_2 concentration of 1%, the rhenium-based catalyst showed very high selectivity (94%) towards carbon monoxide (CO) formation (see **Figure 2**.).

A likely reason behind the high performance, the researchers say, is the efficient insertion of CO_2 into the rhenium–oxygen bond.

The researchers aim to continue systematically investigating promising strategies to help reduce real-world CO_2 levels.

The present study was supported by a CREST (Core Research for Evolutional Science and Technology) program on Molecular Technology backed by the Japan Science and Technology Agency (JST).

The paper has been selected as part of the 2018 *ChemSci* Pick of the Week Collection and a news story are posted on News & events of Royal Society of Chemistry.

Figure 1. Photograph of the experimental setup for bulk electrolysis
The CO_2 reduction reaction takes place in the cathodic chamber shown on the right.

Figure 2. Representation of the electrocatalytic reduction system
Electrocatalytic reduction of low-concentration CO_2 was achieved using a rhenium-based complex with high CO_2-capturing ability.

Technical term

[1] Electrocatalysis: A process that harnesses electrochemical reactions to accelerate a particular reaction of interest.

References

Hiromu Kumagai, Tetsuya Nishikawa, Hiroki Koizumi, Taiki Yatsu, Go Sahara, Yasuomi Yamazaki†, Yusuke Tamaki and Osamu Ishitani*, Electrocatalytic Reduction of Low Concentration CO_2. *Chemical Science* (2018), DOI: 10.1039/C8SC04124E
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