Integrated Electrochemical Systems for Scalable CO_2 Conversion to Chemical Feedstocks

Project Manager（PM）：Prof. SUGIYAMA Masakazu, The University of Tokyo

Contact：sugiyama*enesys.rcast.u-tokyo.ac.jp

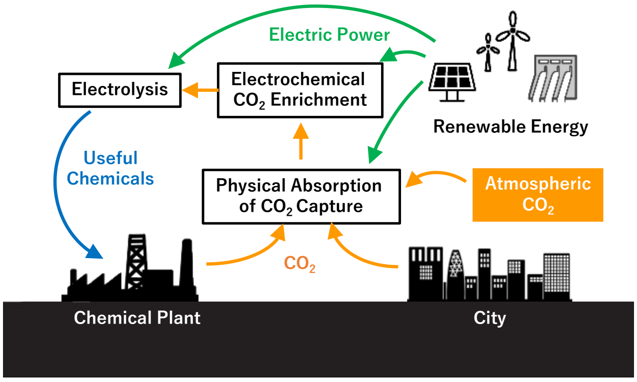
To send an email, please change * to @ in the above email address.

Summary

We will develop an integrated system that recovers and enriches dilute CO_2 from the atmosphere using physical and electrochemical methods and converts it to a resource utilizing an electrochemical process powered by renewable energy.

Targeting dilute CO_2 in the atmosphere as an ultimate goal, we will establish a flexible and scalable system that is distinct from thermochemical plants, which can be distributed on a small scale by taking advantage of the characteristics of electrochemical processes. This will create a technology that can be applied to a wide range of CO_2 emissions sources, from indoor air in buildings to factory exhaust.

The integrated system consists of two main technologies: CO_2 capture and enrichment by both physical and electrochemical methods, and CO_2 reduction to produce useful chemical feedstock (e.g., ethylene). In particular, we will develop core technologies for CO_2 separation and enrichment through electrochemical CO_2 dissolution control and highly efficient and highly selective CO_2 electrochemical reduction through innovative catalysts and reactors. We will integrate these technologies into a unified process and promote plant demonstrations with the aim of socially implementing an innovative CO_2 conversion system to resources.



Establish the Carbon Recycling System
Using Electric Energy as a Platform Energy
～ Toward Reducing 100 Million Ton-CO_2 per Year ～

Targets by 2030

FY2022: Develop/verify devices to demonstrate that CO_2 emissions can be reduced to between +1.0 and +1.5 tons per ton of ethylene produced. (Note 1, Reference)

FY2024: Examine the feasibility of a laboratory-scale system and demonstrate that CO_2 emissions can be reduced to between +0.5 and +1.0 tons per ton of ethylene produced, and that continuous operation for 1000 hours can be achieved.

FY2029: A pilot plant will be constructed to achieve carbon negativity, i.e., CO_2 emissions of less than -0.5 tons per ton of ethylene produced. Also, achieve 5000 hours of continuous operation.

Note 1) Includes CO_2 emissions during equipment manufacturing (estimated based on technology as of July 2021).
(Reference) Conventional technologies that use fossil resources as raw materials emit several tons of CO_2 per ton of ethylene produced.

Implementation

The University of Tokyo, Osaka University, Institute of Physical and Chemical Research (RIKEN), Ube Industries, Ltd., Shimizu Corporation, Chiyoda Corporation, Furukawa Electric Co., Ltd.