Integrated Electrochemical Systems for Scalable CO_2 Conversion to Chemical Feedstocks

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

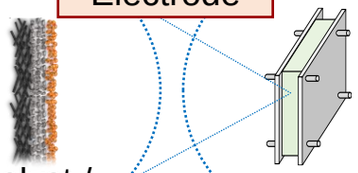
Project organization and goals

MOONSHOT RESEARCH & DEVELOPMENT PROGRAM

NEDO

CO_2 electrolysis reactor

Osaka Univ.
Electrode



Catalyst / Electrode

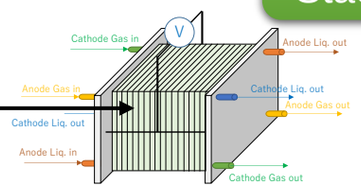
CO_2 electrolysis reactor

Furukawa Electric Co., Ltd.
Cu-based substrates

Ube Industries, Ltd.
Acid-tolerant catalysts

RIKEN
Reactor

Larger electrode area
Stacking of electrodes

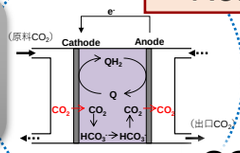


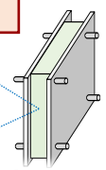
Scale up/ stacking

The Univ. of Tokyo Chiyoda Corp.
Process integration

CO_2 enrichment reactor

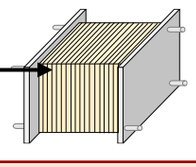
Osaka Univ.
Reactor





CO_2 enrichment reactor

Electrochemical reaction system

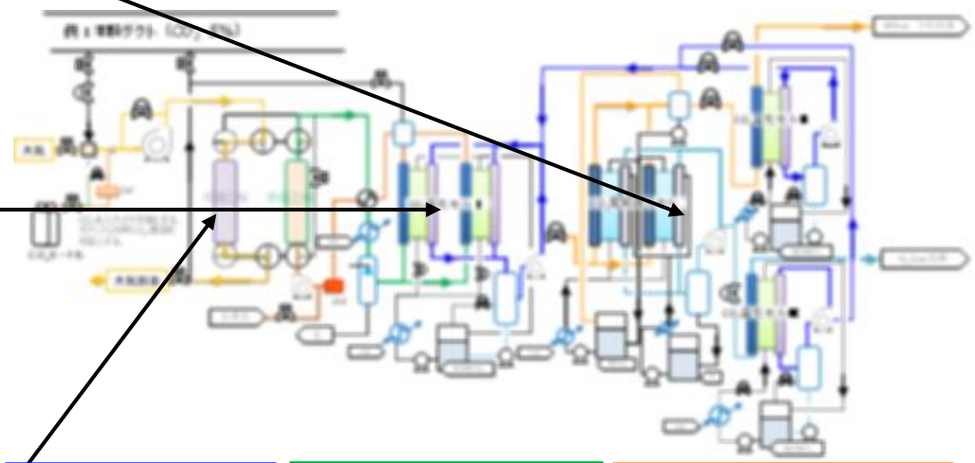


Scale up/ stacking

System development

The Univ. of Tokyo・Chiyoda Corp.
Process integration / system control / characterization

The Univ. of Tokyo
LCA analysis



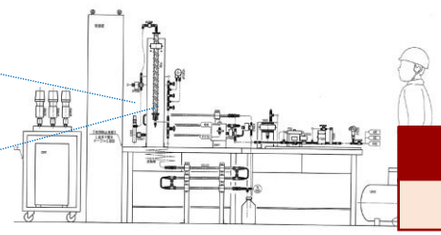
CO_2 Capture

CO_2 Enrichment

CO_2 Electrolysis

Physical CO_2 capture

Adsorption / desorption material



Adsorption / Desorption system

Shimizu Corp.
Prototyping

Shimizu Corp.
Process concept

Ube Industries, Ltd.
Provisional pilot field / Social implementation scenario

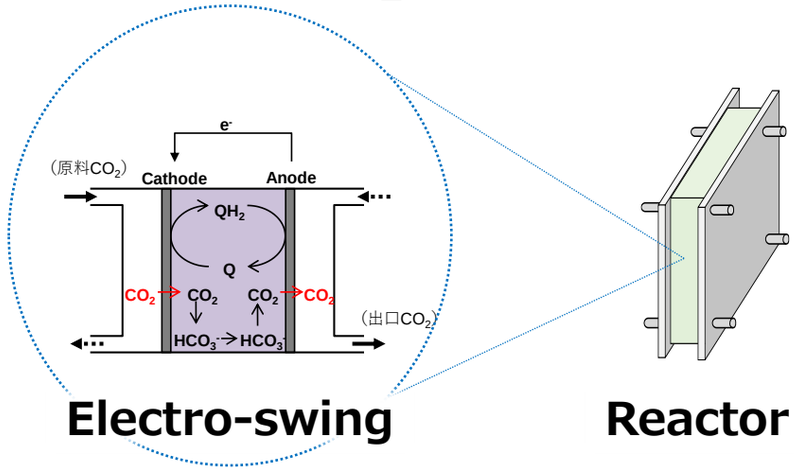
Goals

- Development of an integrated system that electrochemically converts CO_2 captured from an atmospheric air to valuable chemical substances
- Conducting a life cycle assessment on a pilot-scale plant to evaluate the effectiveness as a measure against global warming

Research subjects and goals

Research subject ①-2

Development of the electrochemical reactor for CO_2 enrichment



Electro-swing

Reactor

CO_2/O_2 → CO_2
CO_2/C_2H_4 → CO_2

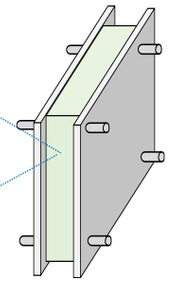
The goal in 2024

Operation of the integrated system of physical DAC, electrochemical CO_2 enrichment, and CO_2 electrolysis reactors.

Research subject ②-2-B

Development of the reactor for CO_2 electrolysis

Catalysts/Electrode



Reactor

CO_2 → C_2H_4

The goal in 2024

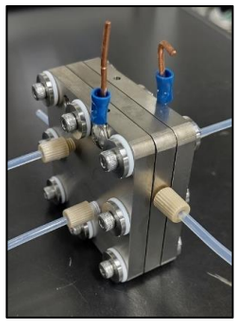
2.5 V、200 mA/cm^2
Faradaic efficiency for C_2H_4: 50%

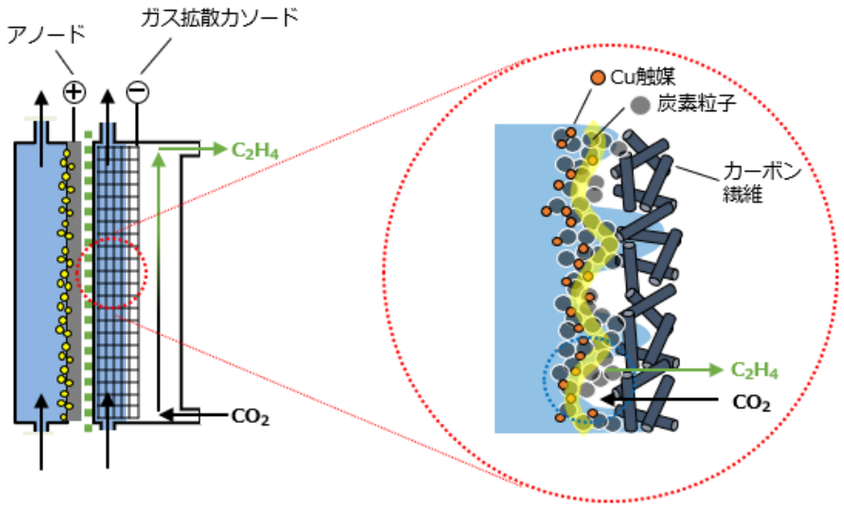
The goal in 2027

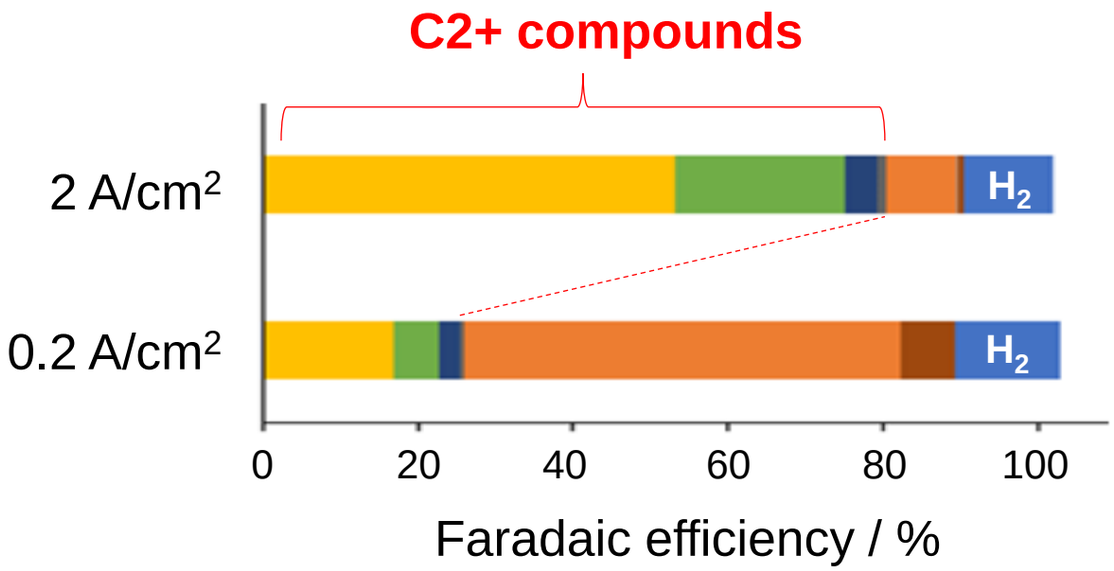
2.5 V、200 mA/cm^2, Faradaic efficiency for C_2H_4: 80%, 1000 h in the integrated system.

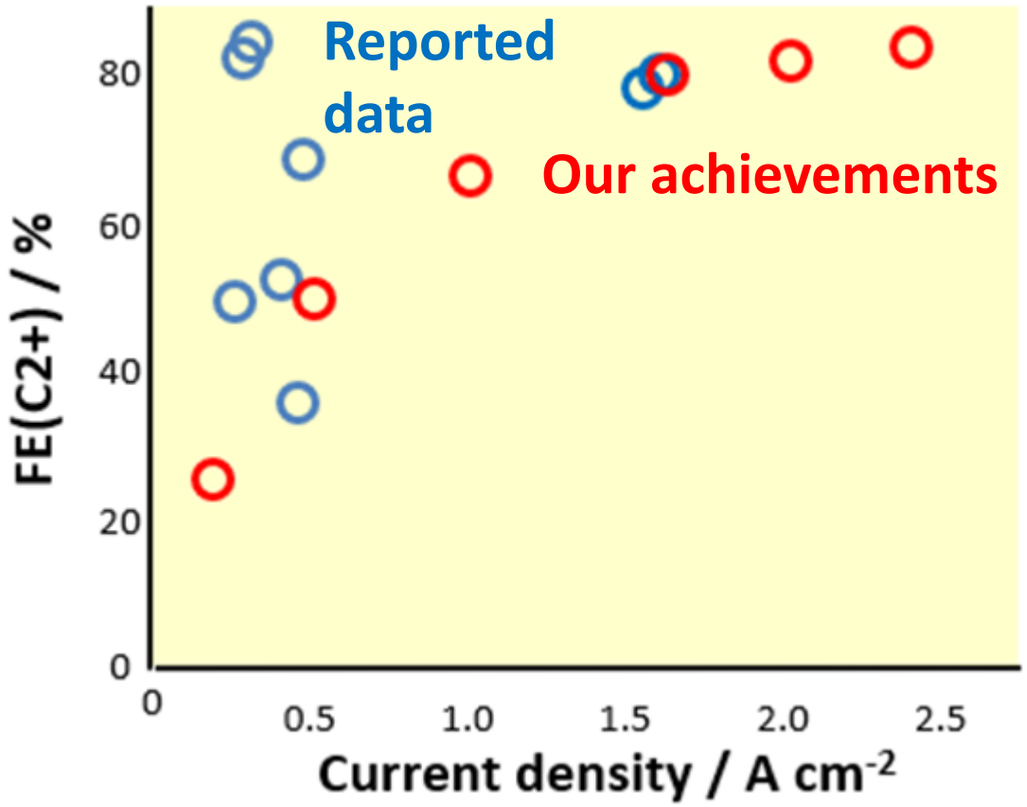
Achievement 1

❑Ultra-high-rate electrolysis of CO_2 to C2+ compounds



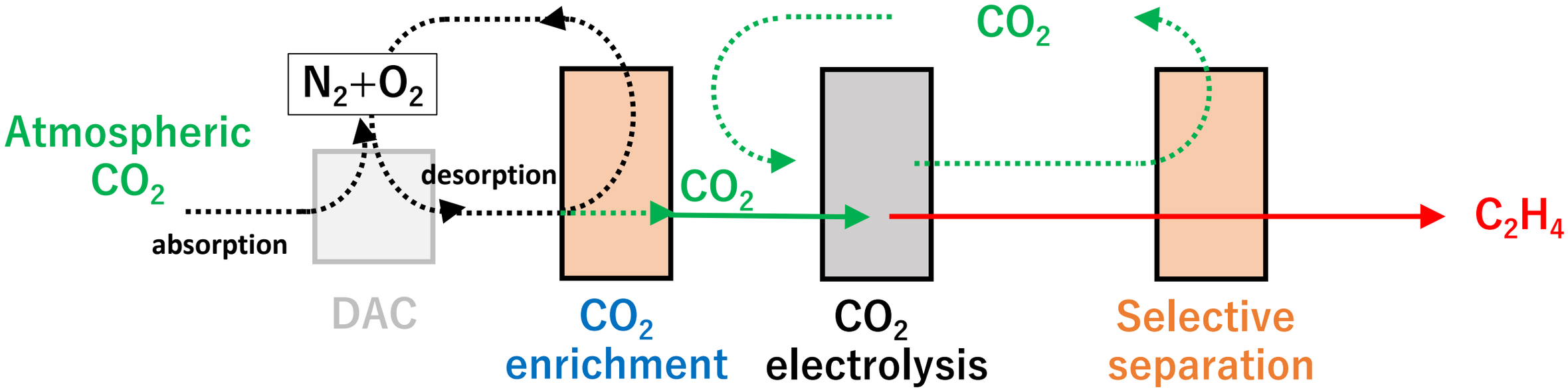


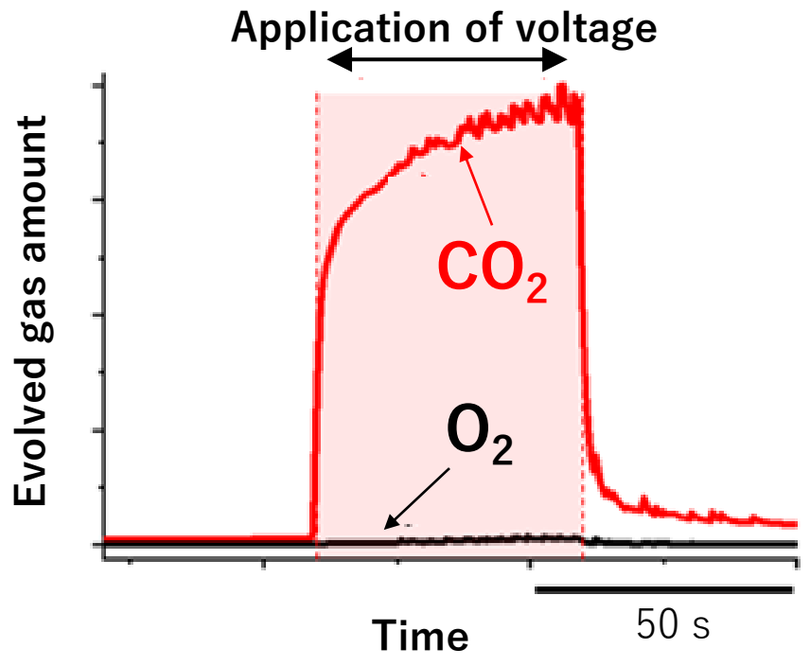




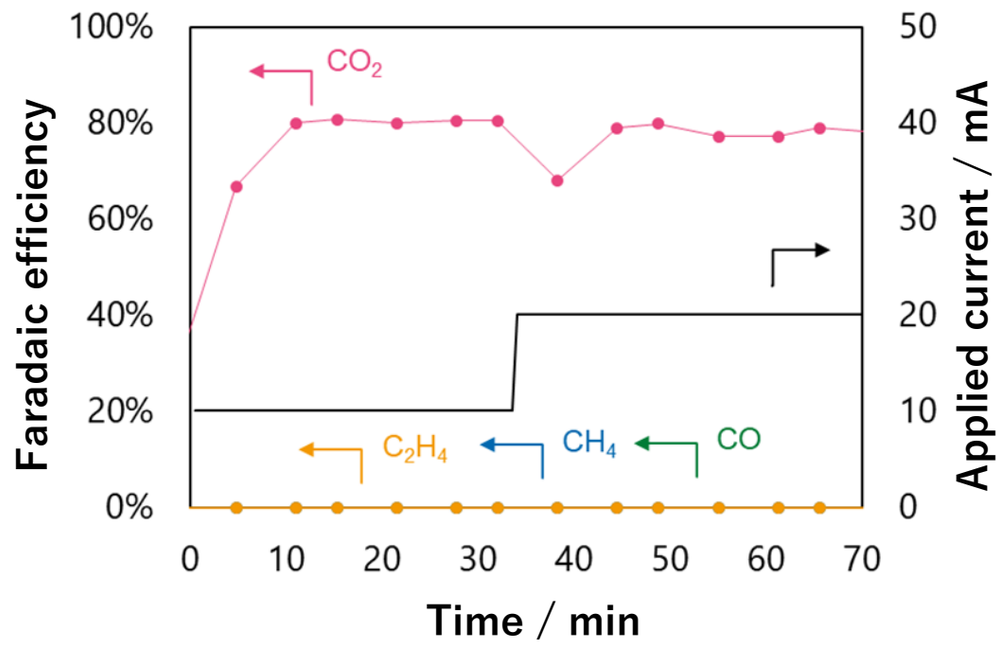
Achievement 2

❑Selective enrichment and separation of CO_2





Separation from CO_2/O_2 mixed gas



Separation from mixed gaseous products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