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.

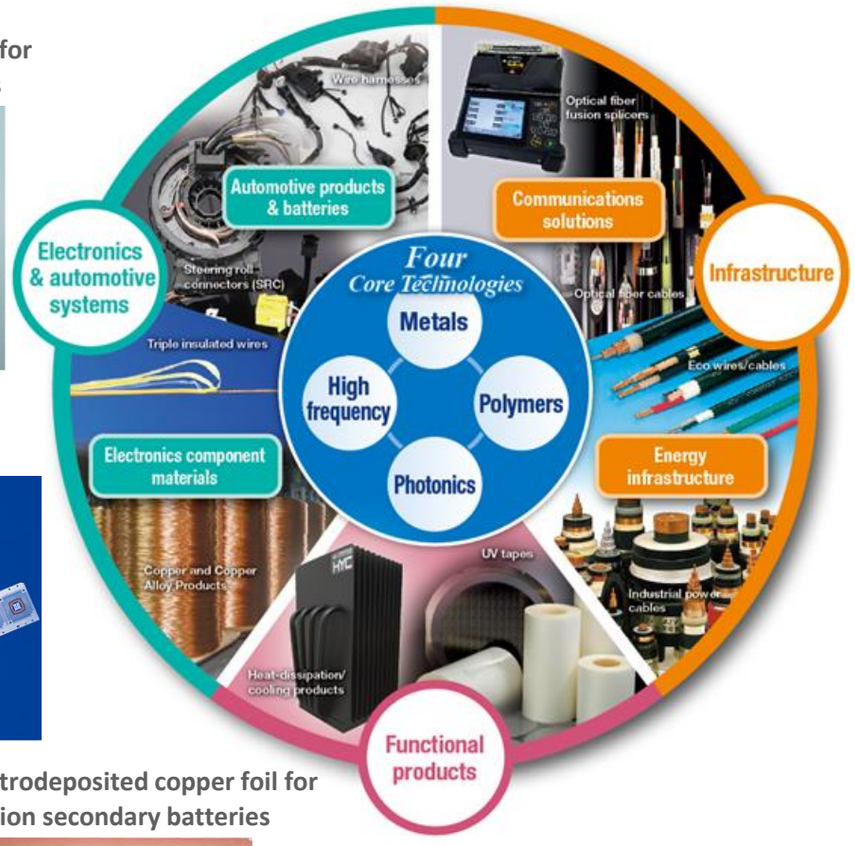
Furukawa Electric / Business segment / Role in this Project

❑Business segment / Strength

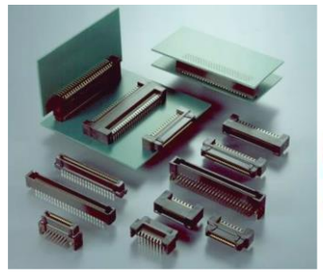
Furukawa Electric is developing a wide range of products in **three business segments** of **Infrastructure**, **Electronics & automotive systems** and **Functional products** using **metals**, **polymers**, **photonics** and **high frequency** as our four core technologies.
Furukawa Electric products are contributing to society in many business areas, including some that have the number one global market share.

In this project, Furukawa electric is developing Cu-based catalyst electrode for CO_2 electrolysis using our core technology of metals, especially copper.

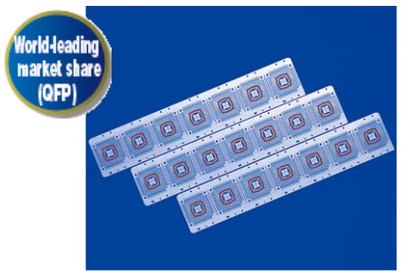
Three Business Segments



"EFCUBE"copper alloy trips for connecting circuit boards



EFTEC-64T
lead frame materials



WS Foil electrodeposited copper foil for lithium-ion secondary batteries

❑Role in this Project

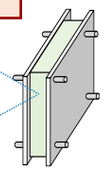
Development of Cu-based catalyst electrode for CO_2 electrolysis:
Developing Cu-based catalyst electrode for CO_2 electrolysis of high Faradaic efficiency for C_2H_4 and high current density

Project organization and goals

CO_2 electrolysis reactor

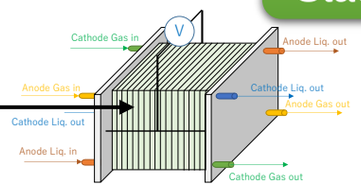
Osaka Univ.
Electrode

Catalyst / Electrode



CO_2 electrolysis reactor

Larger electrode area
Stacking of electrodes



Scale up/ stacking

System development

Furukawa Electric Co., Ltd.
Cu-based substrates

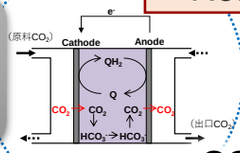
Ube Industries, Ltd.
Acid-tolerant catalysts

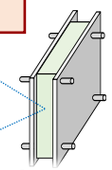
RIKEN
Reactor

The Univ. of Tokyo Chiyoda Corp.
Process integration

CO_2 enrichment reactor

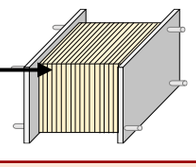
Osaka Univ.
Reactor





CO_2 enrichment reactor

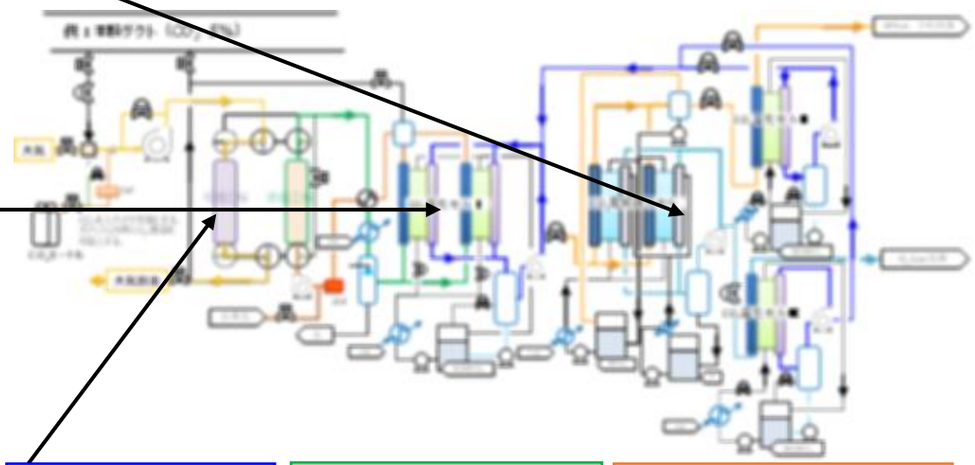
Electrochemical reaction system



Scale up/ stacking

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

The Univ. of Tokyo
LCA analysis



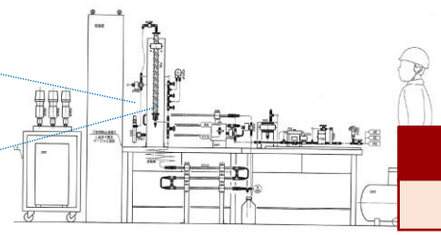
CO_2 Capture

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

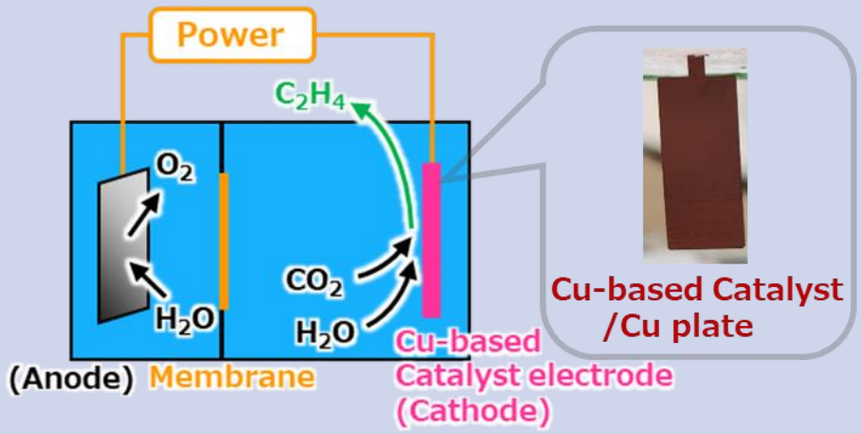
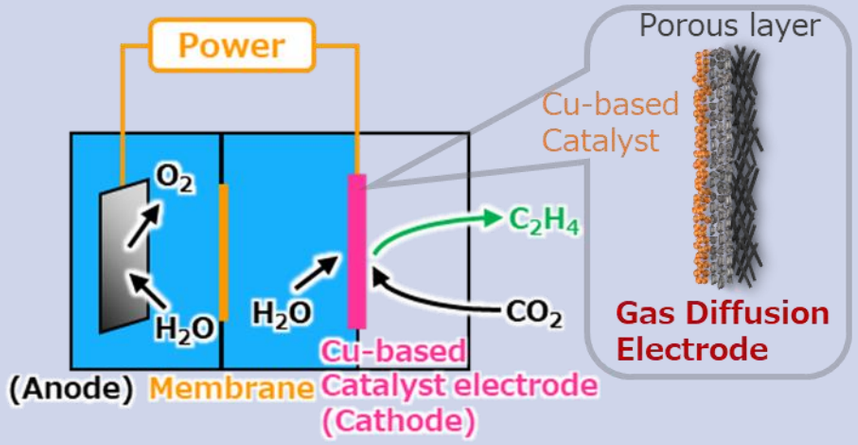
Research subjects and goals

☐Research subjects

Development of Cu-based catalyst electrode for CO_2 electrolysis:

Developing Cu-based catalyst electrode for CO_2 electrolysis of high Faradaic efficiency for C_2H_4 and high current density

☐Goals in FY2027

	At the start of this project	Goals in FY2027
Faradaic efficiency for C_2H_4	30%	80%
Current density	5mA/cm^2	200mA/cm^2
Catalyst electrode for CO_2 electrolysis CO_2 electrolysis reactor		

Goals

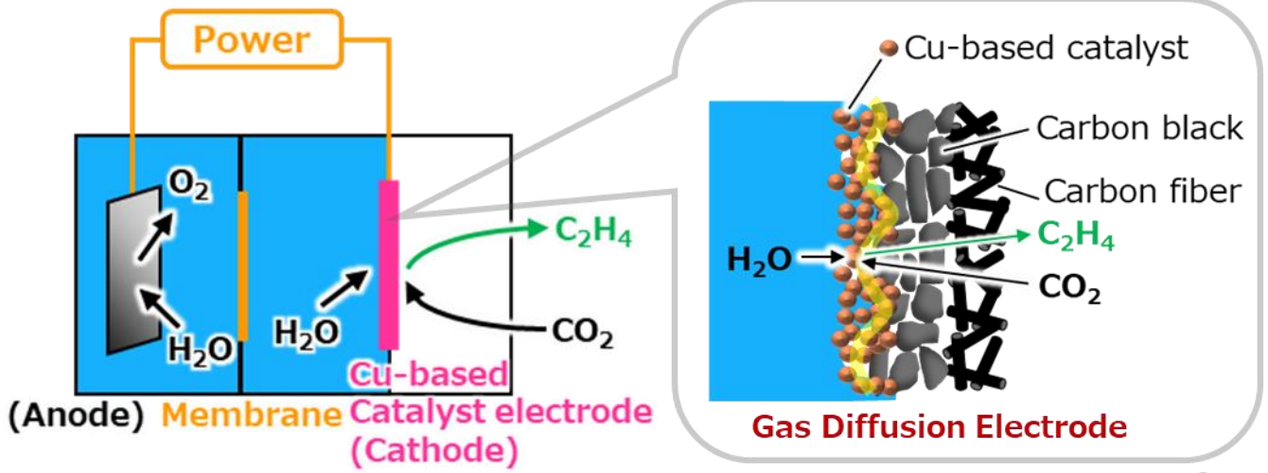
Development of Cu-based catalyst electrode for CO_2 electrolysis

	Current density	Faradaic efficiency for C_2H_4	Goals for practical use
FY2024	200mA/cm^2	50%	Clarification of solutions to development issues for scale-up of Cu-based catalyst electrode aiming for practical use
FY2027	200mA/cm^2	80%	Confirmation of the required specifications for pilot design and continuous operation for 1,000 hours

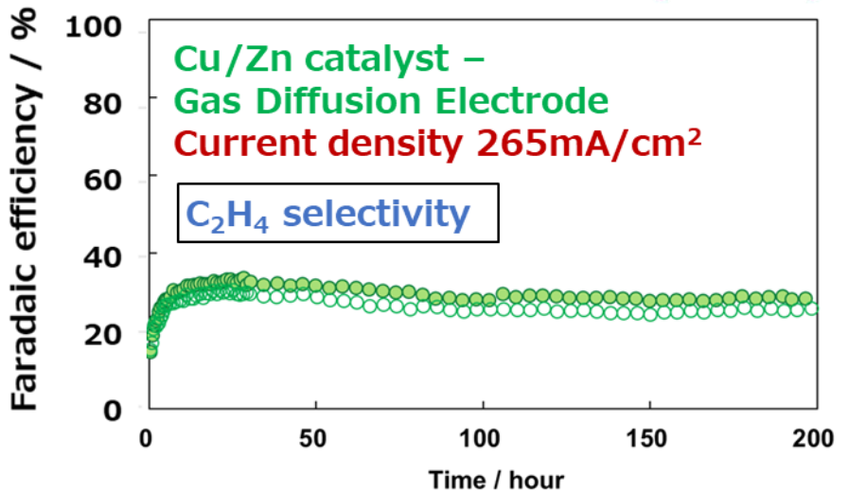
Achievement

Development of Cu-based catalyst electrode for CO_2 electrolysis

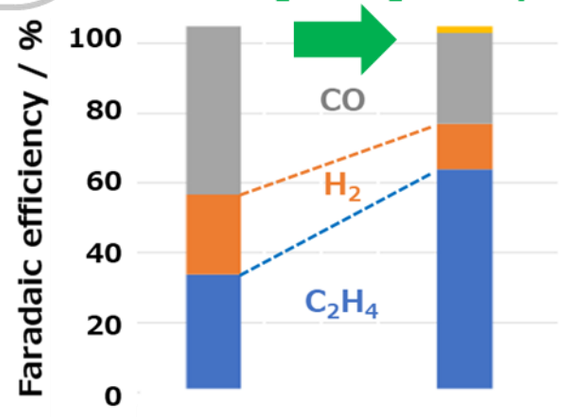
Goals	Current density	Faradaic efficiency for C_2H_4
FY2024	200mA/cm^2	50%
FY2027	200mA/cm^2	80%



Osaka Univ.
Chiyoda Corp.
Furukawa Electric



Optimization of the interface of H_2O-CO_2-Catalyst



Faradaic efficiency for C_2H_4 : 33% → 64%
Current density 128mA/cm^2

Development of Cu/Zn catalyst – Gas Diffusion Electrode

- **Current density 265mA/cm^2**
- Continuous operation 200h

Optimization of the interface of H_2O-CO_2-Catalyst

- Current density 128mA/cm^2
- **Faradaic efficiency for C_2H_4 64%**

MOONSHOT
RESEARCH & DEVELOPMENT PROGRAM