Development of Highly Efficient Direct Air Capture (DAC) and Carbon Recycling Technologies

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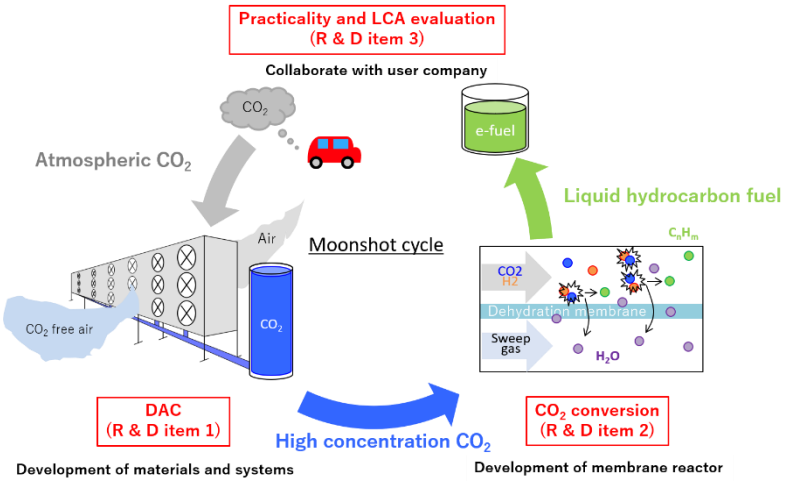
Summary

The following three items will be developed for establishing a carbon recycling technology which capture CO_2 directory from the atmosphere (Direct Air Capture) and convert the recovered CO_2 into valuable resources.

R & D items 1. "Development of high-efficiency CO_2 capture technology from the atmosphere"
(1) Develop a new solid sorbent material for capturing low-concentration CO_2, and (2) Develop a system that can recover low-concentration CO_2 with high efficiency.

R & D items 2. "Development of CO_2 conversion technology for carbon recycling into valuable resources"
・ Development of CO_2 conversion technology (FT synthesis) using an inorganic separation membrane reactor for synthesizing liquid hydrocarbon fuel from CO_2 in the highest efficiency and the lowest energy consumption.

R & D items 3. "Practicality assessment as a liquid hydrocarbon fuel using LCA method"
・ Life cycle assessment (LCA) and economic evaluation of the CO_2 conversion process to liquid hydrocarbon fuel, derived from the atmosphere.



Conceptual diagram of this research and development

Targets by 2030

FY2022: Finding out a new solid sorbent material for capturing low-concentration CO_2, DAC.
Achievement of a low-temperature heat driven TSA process for a rough enrichment of CO_2 from air.
Development of the water separation and hydrogen separation membranes for membrane reactor, and demonstration of the effectiveness of membrane reactors for FT synthesis in lab-scale experiments.

FY2024: Determining the appropriate amine species and its supporting solid material for a pilot-scale DAC test.
Proposal of a process configuration of DAC system for high enrichment of CO_2 and further improvement.
Clarifying the optimal operating condition for the FT synthesis satisfying the specification of liquid hydrocarbon fuel on a lab level.

FY2029: Establishing the DAC technology providing high enough concentration CO_2 to the FT synthesis process.
Developing a high-efficient FT synthesis converting the recovered CO_2 to a liquid hydrocarbon fuel.
Final confirmation of the net CO_2 reduction amount produced by the whole of the DAC ＆ FT synthesis system by applying the Life Cycle Assessment.

Implementation System

Kanazawa University, Research Institute of Innovative Technology for the Earth