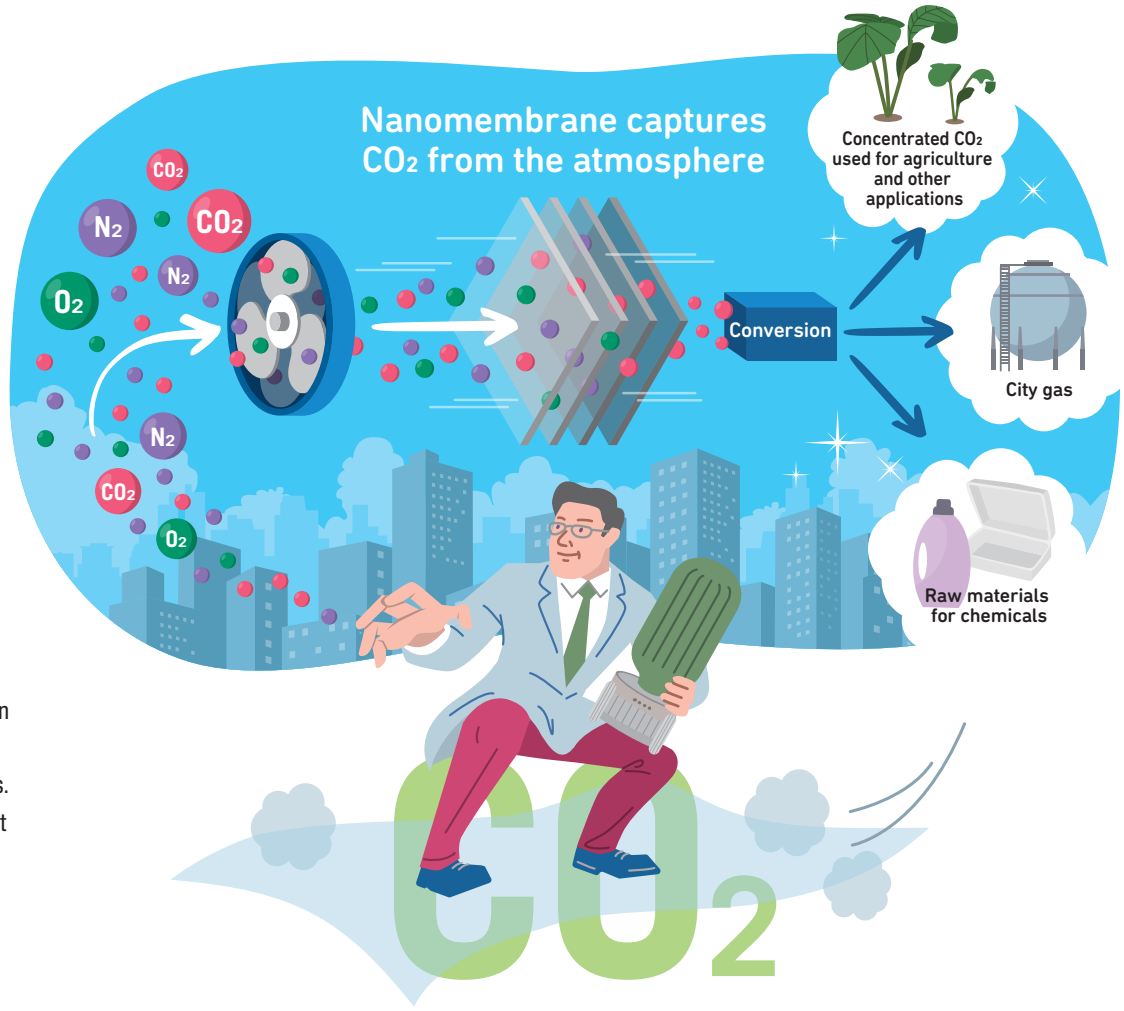
05 PROJECT

CO_2 Capture Anywhere Using Ultrathin Membranes

Development of a CO_2 Recycling System for a Beyond-Zero Society

How can plants absorb CO_2 and perform photosynthesis anywhere simply by spreading their leaves? Our research began with this simple question. Extensive trials led to success in developing an ultra-thin nanomembrane, one like a cell membrane. Widespread use of this compact and size-scalable system for CO_2 capture and utilization at homes and business will enable CO_2 capture and use in our daily lives. We aim to contribute to the revitalization of the global environment by building social infrastructure that can directly capture and utilize CO_2 in the atmosphere, anywhere and anytime.



Friend or Foe? Getting to the Heart of CO_2 and Beyond

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CO_2 is often called the main cause of global warming. But is that right? If we can control the circulation of CO_2 as a resource, we can then create value from it, turning it into an asset. The value of agricultural products and water depends on where they come from. You probably care about where your food and water are sourced, but have you ever considered the source of the carbon dioxide in the carbonated drinks you drink or the carbon dioxide used in photosynthesis in the crops you eat? The essence of our research addresses the development of social infrastructure and a system that gives new value to CO_2. Our goal is to go “Beyond-Zero!”

CO_2 Capture Anywhere Using Ultrathin Membranes

» Efficient CO_2 Separation With an Ultrathin Membrane

This system features a separation membrane that captures CO_2 directly from the atmosphere and converts the captured CO_2 into a resource. We will combine these units as a single system called DAC-U® (Direct Air Capture Utilization system). Conventional membrane separator systems have been impractical, since only minuscule amounts of CO_2 are separated. However, as a result of extensive research focused on developing thinner membranes, we succeeded in fabricating an ultrathin membrane 1/300th the thickness of household plastic wrap, which is close to the thickness of plant cell membranes. This ultrathin membrane exhibits extraordinarily high CO_2 permeability (20 times or greater), compared to conventional membrane performance. This high CO_2 permeability enables economically efficient direct CO_2 capture with membranes.

» Toward a Society That Fully Recycles CO_2

The DAC-U® system offers a range of potential applications for captured CO_2, including its use in agriculture. Additionally, it can be chemically converted for use as a raw material for city gas or industrial chemical products. Furthermore, concentrated CO_2 can be used directly in general households to make carbonated water. The DAC-U® system has the benefit of sharing a common feature with photovoltaic systems, namely the ability to accommodate flexible unit combinations. Its design allows for a range of combinations and scales, offering the versatility to meet the specific needs of each installation site, so it can capture and recycle CO_2 anywhere, from homes to public facilities, parks, and office buildings. This system contributes to the creation of a ***carbon recycling society*** for local production and consumption of atmospheric carbon sources.

KEYWORD

Carbon Recycling Society

We believe that the direct use and conversion of captured CO_2 can create a carbon resource recycling process. If we make it possible not only to capture CO_2 but also reuse it, we will be taking a step towards achieving a carbon-neutral society.

FUTURE VISION

2025

Debut DAC-U® System

We will develop a first prototype of the DAC-U® system.

2027

Test the Prototype

There are numerous applications for DAC-U® systems. We will produce and test prototypes for use in a variety of applications.

2029

Develop Systems for Everyday Needs

The objective is to gradually improve performance and enable more efficient capture of CO_2, specifically capturing about 2 kg per day, or enough to cover the daily energy needs of a family of four.

Implementation Kyushu University, Kumamoto University, Hokkaido University

Project Introduction Video https://www.youtube.com/watch?v=iNjqtC22C-g&list=PLZH3AKTCrVsVm3UN1x40WW_QK-cEXaoo3