

RITE has received an award for developing "Sub-Nano Structure Controlled Materials: Development of Innovative Gas Separation Membranes" from the GCEP (Global Climate and Energy Project) of Stanford University, USA. In this project, synergism of research into both carbon and inorganic materials will lead to innovative materials for gas separation membranes.

### Carbon membrane

In the organic materials approach, sub-nanostructure controlled carbon membranes are now under research. Conventional carbon membranes use molecular sieving of gases with different molecular diameters to get good gas selectivity.

RITE's novel carbon membrane is a thin layer of microporous carbon deposited on a porous alumina tube. Figure 1 shows the basic outline of RITE's novel carbon membrane.

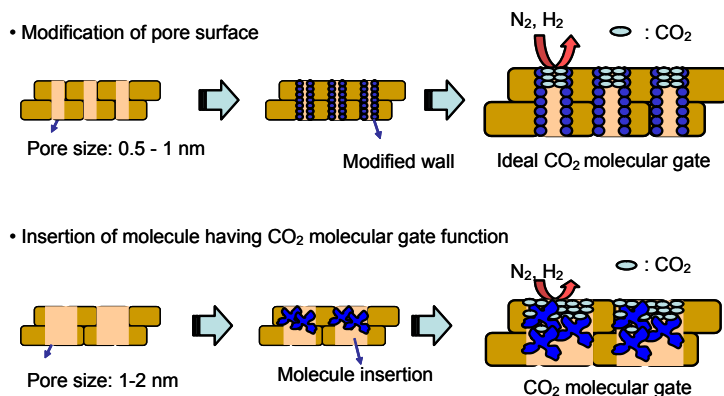


Fig.1 Modification of pore property for high CO<sub>2</sub> affinity in carbon membrane

In the figure, micropores obtain a molecular gate function by modification of pore surfaces or insertion of dendrimers. The CO<sub>2</sub> molecules occupying the pores work to block the passage of other gases. Consequently, excellent CO<sub>2</sub> selectivity is obtained with the carbon membrane.

### Inorganic membrane (zeolite membrane)

We are now investigating an optimum zeolite structure and preparation of a grain-boundary/pinhole free zeolite membrane by molecular simulation. Based on the simulation results, we have selected some new candidate zeolite structures for CO<sub>2</sub>-N<sub>2</sub> or CO<sub>2</sub>-H<sub>2</sub> separation and have started synthesis of a new zeolite membrane. Synthetic conditions for zeolite seed crystals have been studied and, recently, we have successfully synthesized a new zeolite seed crystal which has never previously been used for a zeolite membrane. In addition, as shown in Figure 2, a new preparation method for zeolite membrane for growing zeolite crystals inside the pores of porous alumina substrate has been proposed.

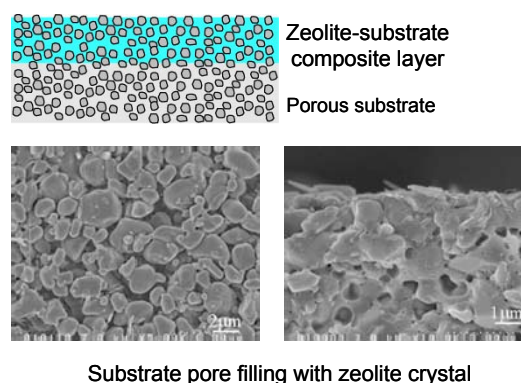
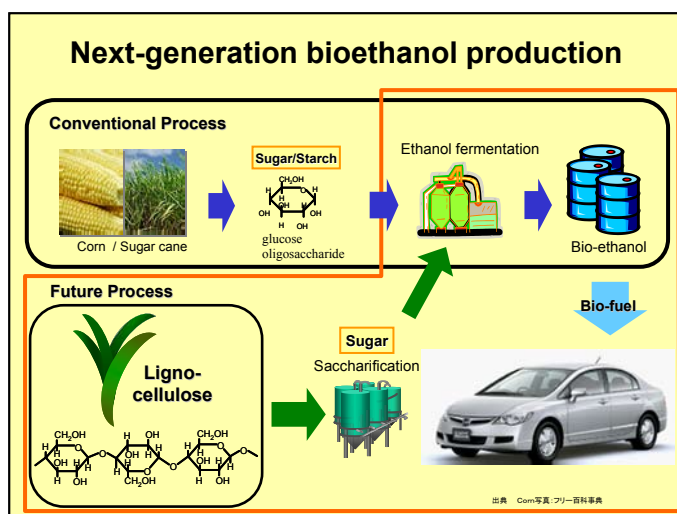


Fig.2 New preparation method for zeolite membrane

## Collaborative R&D in Bioethanol production

Microbiology Research Group

As a part of our project to produce valuable substances from biomass in the Microbiology Research Group, we are carrying out R&D to produce bioethanol with industries. In the conventional bioethanol production, food part of sugarcane and corn are used. However, in our new process, ethanol is produced from non-food parts such as leaves and stems. The non-food part is called lignocellulose and those are hydrolyzed to glucose before converted into ethanol. In the pre-treatment process to hydrolyze lignocellulose to glucose, fermentation inhibitors are also produced and the activities of microorganisms, such as yeast used in the



conventional application, are inhibited. On the contrary, fermentation inhibitors were found not to have significant effect on the corynebacteria used in our group as these are used in growth arrested state. In our group, we are planning to build a pilot plant with a car manufacturing company(Honda) to examine our novel process.

## Commentary published in Nature Biotechnology

Microbiology Research Group

In the Microbiology Research Group, we are carrying out R&D to produce valuable substances from biomass (biorefinery). Biorefinery, which converts renewable biomass to fuel and chemicals, has been attracting attention as a fossil fuel-independent alternative to petroleum-based processes. Recently, our commentary from the global point of view on the way towards realization of biorefinery and the problems foreseen to encounter during the process to shift from fossil fuels was published in Nature Biotechnology (2006, Vol.24, No7, 761-764).

**Implementing biofuels on a global scale**

Alain A Vertès  
Masayuki Inui  
& Hideaki Yukawa

**Is the introduction of renewable biofuels a simple problem of technology development and diffusion or does it require an industrial revolution?**

## International Workshop on CO<sub>2</sub> Geological Storage, Japan '06

CO<sub>2</sub> Sequestration Research Group



A workshop entitled "International Workshop on CO<sub>2</sub> Geological Storage, Japan '06" was held on February 20, 21, 2006 at the Toranomon Pastoral Hotel Tokyo Japan.

This workshop was hosted by RITE as a part of CO<sub>2</sub> Geological Storage Research Project for the confidence building in Japan. Approximately 300 attendants for 2 days including 20 from overseas and also mainly from private sectors and research organizations listened to the presentations eagerly.

Also NGO, NPO persons joined the workshop. This workshop provided the research result of the Nagaoka Project including overseas CCS trend information and useful discussion about CCS.

## 2007 RITE International Symposium

-Technologies for mitigating global warming and the role of Japan-

Planning, Survey and Public Relations Group

The symposium entitled "2007 RITE International Symposium – Technologies for mitigating global warming and the role of Japan –" was held on 18 January 2007, at the Shinagawa Intercity Hall.

This symposium was organized by RITE (Research Institute of Innovative Technology for the Earth), co-organized by NEDO (New Energy and Industrial Technology Development Organization), and supported by METI (Ministry of Economy, Trade and Industry), SCEJ (The Society of Chemical Engineers, Japan), JSER (Japan Society of Energy and Resources), JIE (The Japan Institute of Energy), and JSBBA (Japan Society for Bioscience, Biotechnology, and Agrochemistry).

As the keynote speaker, Dr. Levine of Lawrence Berkeley National Laboratory outlined the energy and climate change issues. As the representatives of Japanese industrial sector, Mr. Furuno of Toyota Motor Corporation and Mr. Ono of Nippon Steel Corporation presented their challenges for the GHG reduction. In the afternoon session, Dr. Metting of Pacific Northwest



National Laboratory presented an overview on the biofuel technologies in the US and Dr. Yukawa of RITE highlighted the R&D of RITE in this field. Regarding CO<sub>2</sub> geological storage, Mr. Kaarstad of Statoil spoke about the current activities and future potential and Dr. Ohsumi of RITE presented Japanese achievement. The symposium closed with the speech by Dr. Kaya of RITE and he provided his insight into the Japan's strategy for mitigating climate change.