



Ceramic Membranes for Carbon Capture and Storage

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Descriptions of Research Topics

- Development of gas separation membranes
- Optimization of membrane processes for gas separation
- Modularization and scale up membrane processes
- Characterization of membrane pore properties

Applications:

- Contact membrane process for CO₂ capture
- Water treatment and reuse, TiO₂ coated membrane
- Oxygen separation for oxy-fuel combustion
- Hydrogen separation for pre-combustion

Materials

Membrane Preparation

Application

Modularization

CETRSL
 Clean Energy & Technology for Reaction and Separation Lab.

Membrane/Absorbent hybrid process for CO₂ capture

- Gas/Liquid contact through membrane
- High effective area
- Prevention forming, flooding and drifting
- Easy to scale up

Furnace

Module

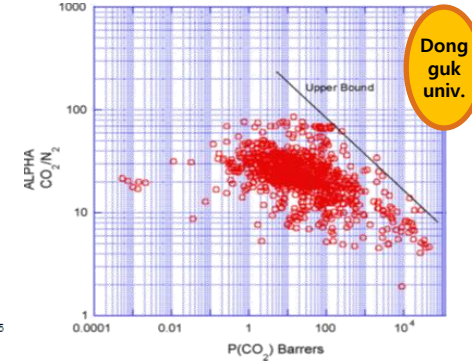
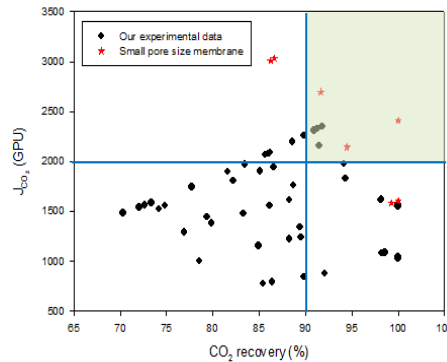
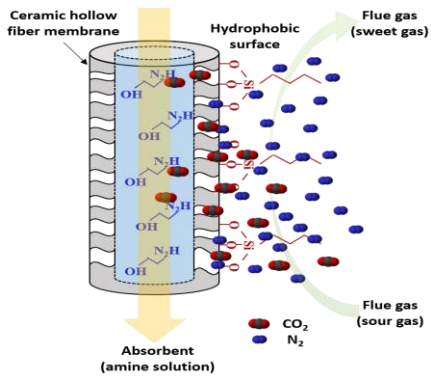
1 hole → 3 hole → 5 hole → 16 hole

Research Fields 1 Ceramic Membrane 2 Energy-Resource

Keywords Membrane, Surface, Coating, Hydrogen, Oxygen, Carbon dioxide, Water treatment, Pore structure control, Sintering, Powder synthesis

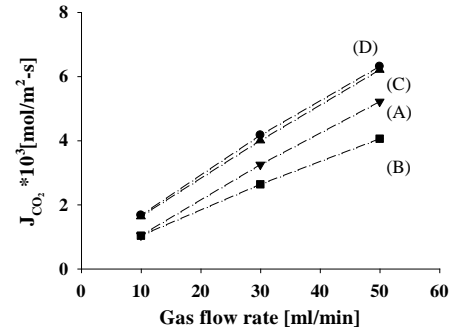
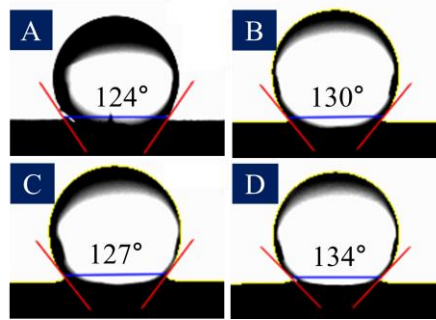
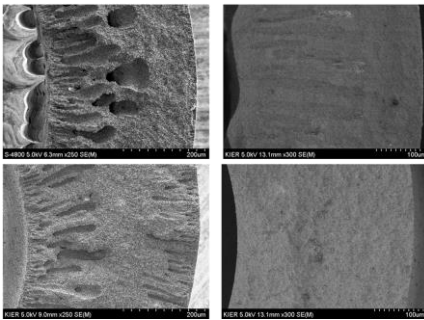
Contactor membrane process for CO₂ capture

Contactor Process



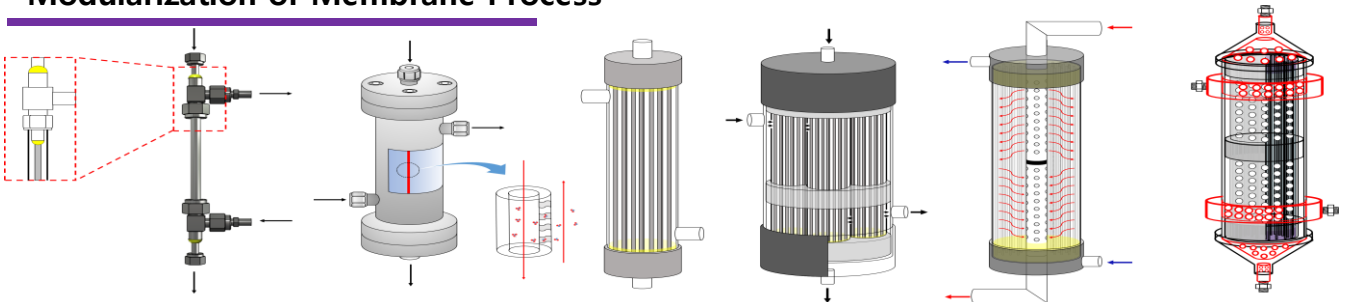
- The CO₂ capture process using the contact separation membrane is a new concept technology that increases the CO₂ separation efficiency by contacting the gas and liquid through the separation membrane
- Operation of contact membrane process without swelling by using hydrophobic ceramic membrane with chemical stability

Optimization of Ceramic Membrane



- Preparation of High Permeability and Hydrophobic Ceramic Membrane by Pore Structure Control
- Optimization of contact membrane process

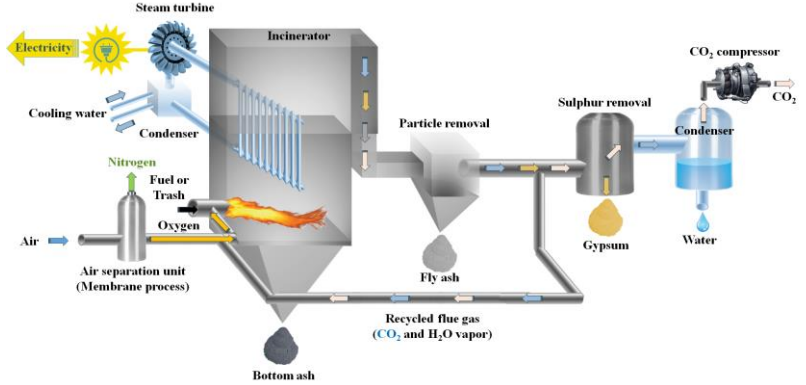
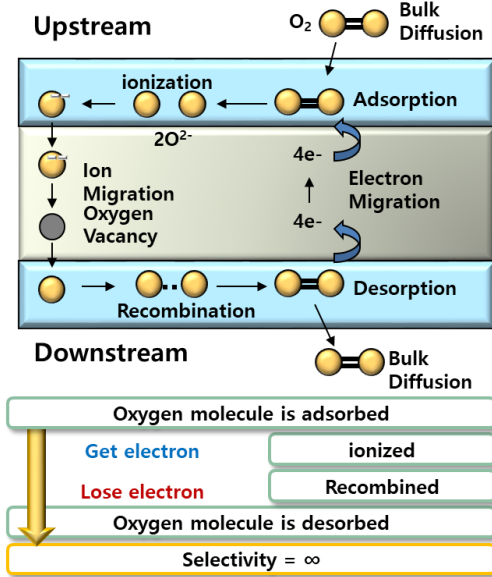
Modularization of Membrane Process



- Development of a large scale module with ceramic membranes
- Optimization of membrane module to control temperature and pressure (Membrane/absorbent interfacial area > 500 m⁻¹)

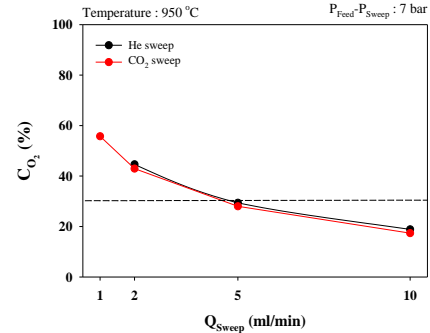
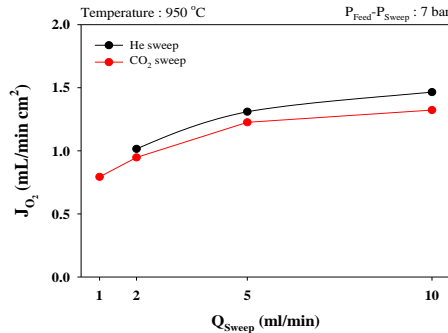
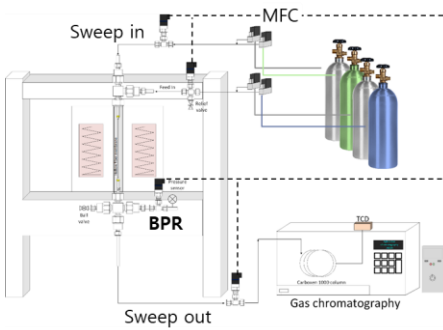
Ion Transport Membrane for Oxygen Separation

Concept



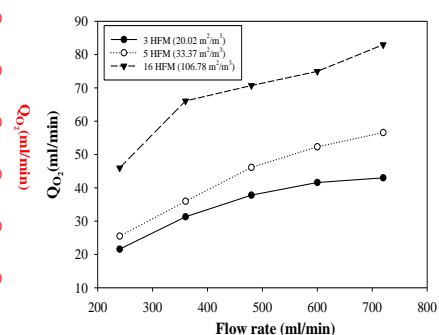
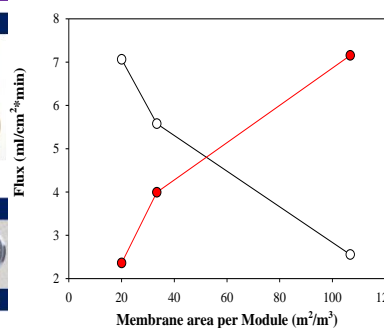
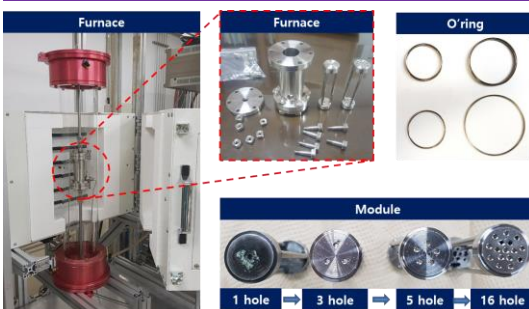
- Oxygen separator process for oxy-fuel combustion process and oxygen-enriched combustion process
- Development of new composition membrane with carbon dioxide resistance

Carbon Dioxide Resistant Membrane



- Improved durability of new composition coating membrane
- Maintain performance over 85% under carbon dioxide sweep conditions

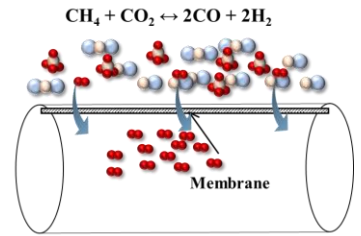
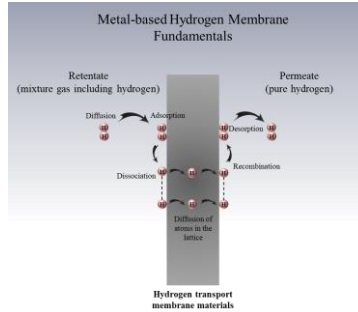
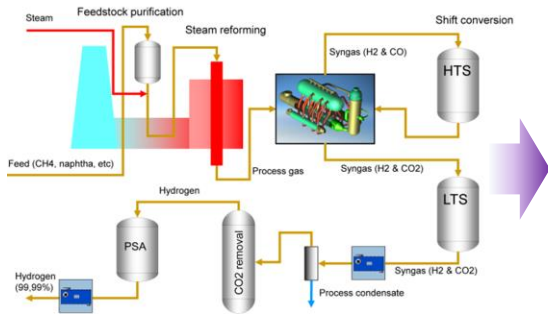
Modularization of Membrane Process



- Development of hollow fiber ceramic membrane proto type module
- Obtain membrane technology and module design technology to develop commercial process

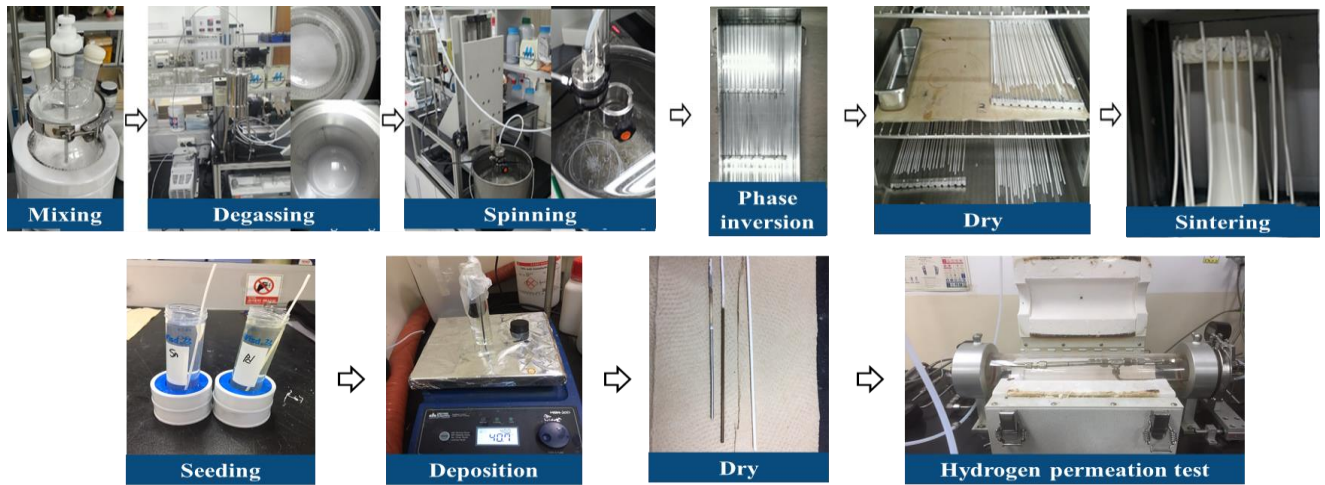
Pd Membrane for Hydrogen Separation

Concept



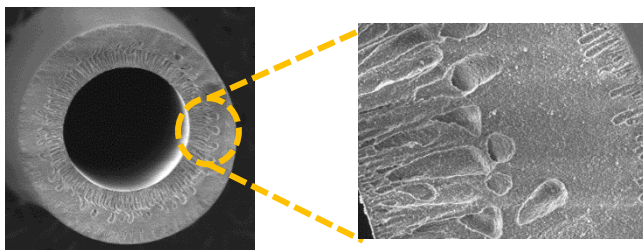
- Hydrogen membrane technology to replace existing low energy-efficient processes
- Development of membrane reactor technology capable of reaction and separation

Preparation Hollow Fiber Membrane and Electroless plating Pd Coating



- Fabrication of hollow fiber membrane by phase inversion and Pd Coating by Electroless Plating

Optimization of Coating Membrane



- Confirm of Pd coating properties by membrane pore structure and electroless plating method
- Analysis of permeation selectivity of membrane by pressure and various simulated gas composition

