

**Battelle Number(s):**

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# Immobilized Liquid Membranes for CO<sub>2</sub> Capture

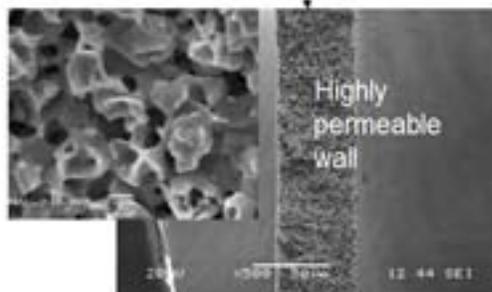
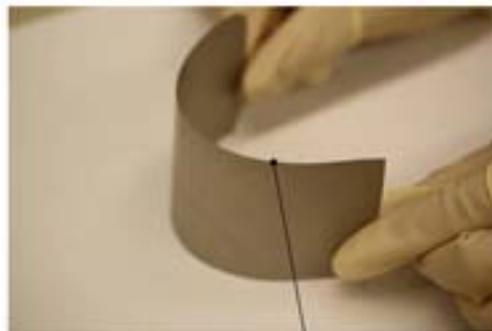
## SUMMARY

Researchers at PNNL have developed an inexpensive, 50 micrometer-thin ceramic/metal flat sheet membrane technology that provides high surface area and high gas permeance for CO<sub>2</sub> separation from large volume of gas streams with low pressure drops. The technology, referred to as Immobilized Liquid Membranes for CO<sub>2</sub> Capture, enables incorporation of catalytic materials to speed-up of CO<sub>2</sub> adsorption/reaction rates and immobilization using a very thin layer of CO<sub>2</sub>-selective fluid.

The membrane is built on a robust, thin porous metal sheet support comprising inter-connected web-like pores at submicrometer sizes through ceramic coatings and pore filling. The ceramic coating reduces the

support pore size to small nanoscale pores, which can be catalytically active. Then, the nano-scale pore is filled with a CO<sub>2</sub> selection fluid such as an ionic liquid, which has non-volatile and high stability features under flue gas conditions. As a CO<sub>2</sub>-containing gas stream flows over the membrane surface, CO<sub>2</sub> is selectively absorbed and reacted with the fluid, and is transported to back side of the membrane under a pressure gradient. Thus, a pure or CO<sub>2</sub>-enriched stream is generated.

Laboratory proof-of-concept tests show the ability of tailoring the porous metal sheet with metal oxide coatings of different pore sizes from tens of nanometer to a few angstrom and immobilization of several fluids withstanding the pressure gradient and hydrodynamic attrition. The possibility to obtain very high CO<sub>2</sub> permeating flux is shown.



## ADVANTAGES

\* The metal-foil like, thin ceramic/metal porous membrane sheets may be manufactured via lower-cost roll-to-roll production. The membrane sheet provides higher mechanical strength and better material stability than conventional porous sheet/plate membranes.

\* The flat sheet membrane enables assembly of membrane modules for gas

separation at high rates with low pressure drops.

- \* The membrane structure enables economic application of relatively expensive CO<sub>2</sub>-selective fluids such as specialized ionic liquids and/or catalysts by substantially reducing amounts of their usage.
- \* The present membrane enables development of compact membrane modules for CO<sub>2</sub> separation from large volume of gas streams such as flue gas.

## RELATED LINKS

### » Clean Fossil Energy at PNNL

Learn more about current research and capabilities

<http://energyenvironment.pnnl.gov/cfel>

### Patents & Intellectual Property

- » Patent Publication #: US 2011/0052466

### Technology Portfolio(s)

- » Carbon Capture & Sequestration

### Potential Industry Applications

- » Energy & Utilities
- » Manufacturing & Warehousing

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**Peter C. Christensen**  
Pacific Northwest National Laboratory  
(509) 371-6159  
peter.christensen@pnnl.gov  
<http://availabletechnologies.pnnl.gov>



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