



## PROCESSING AND ENVIRONMENTAL CATALYSIS

### CLEAN ENERGY TECHNOLOGIES

## EMERGING CERAMIC MEMBRANE TECHNOLOGY



### **A Business Opportunity**

*The CANMET Energy Technology Centre-Ottawa (CETC-Ottawa) has achieved significant advances in ceramic membrane technology and its application. We believe we have "breakthrough" technology that has great potential for commercialization in Canada. CETC-Ottawa is proud to offer this technology and its know-how to Canadian industrial partners for further commercial development.*

### **Opportunity**

#### **Ultimate Product Interest**

The hydrogen-permselective membrane will ultimately be of interest to synthesis gas producers for Fischer-Tropsch synthesis and methanol production. It will be useful for hydrogen production for fuel cells and to industries involved in hydrocarbon production. Membrane reactors offer a new industrial paradigm as they combine reaction and separation in one step. Although this technology is not in use commercially, it has potential for enhancing several processes.

#### **Immediate Product Interest**

The membrane substrate will be of immediate interest to research institutes who conduct research in perfecting membranes or membrane reactors for application in the above mentioned industrial processes.

### **Immediate Technology Interest**

The CETC-Ottawa ceramic membrane technology will be of interest to ceramic membrane manufacturers. Initially, they will be able to supply research institutes to take the above concepts to pre-commercial status.

With commercial success, this technology will open up an entire new market for ceramics in the area of industrial production of synthesis gas, hydrogen and hydrocarbon processing.



*CETC-Ottawa's Membrane Testing Facilities*

## CETC-Ottawa's Expertise and Technology

CETC-Ottawa's experience will give industrial partners a unique advantage in further developing ceramic membrane technology.

The know-how consists of proprietary information on:

- manufacturing uniform and stable asymmetric  $\alpha$ -alumina membrane substrates; and
- synthesis by chemical vapour deposition (CVD) of silica hydrogen-permselective membrane

## Challenges

Industrial reactors require membranes that assure high, selective flux of the desired product. This can only be achieved with an extremely thin membrane, free of cracks and pinholes.

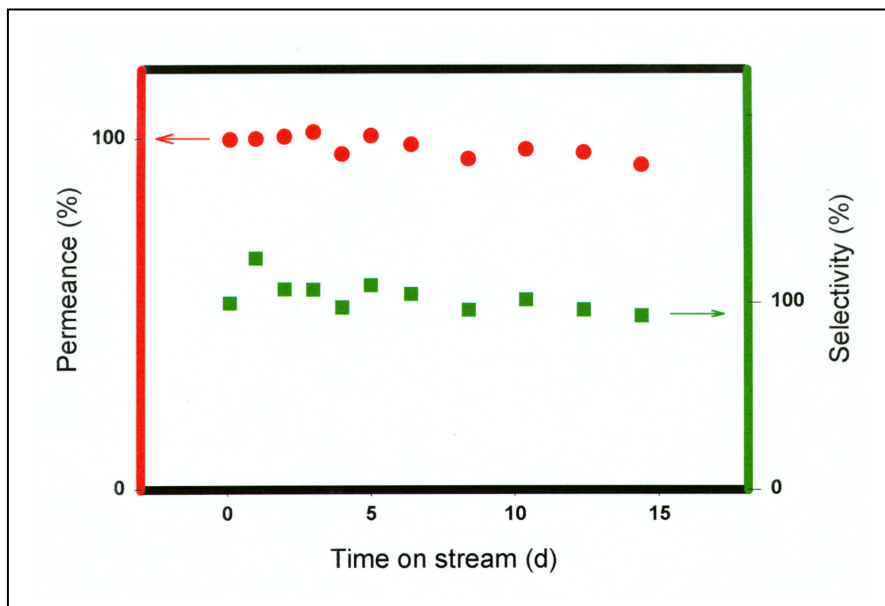
The membrane should be thermally stable and chemically resistant to prolonged operation at high temperatures including thermal cycling. Mechanical strength is needed for integration into industrial operation.

## CETC-Ottawa's Technology

### Success

Our success in this high risk R&D was based on strong support and collaboration of companies participating in the Consortium on the Conversion of Natural Gas (CCNG). CCNG is managed by CETC-Ottawa and partly funded by the federal Program on Energy Research and Development (PERD).

CETC-Ottawa's Membrane Program yielded the world's "best" hydrogen permselective ceramic membrane compared with available literature. New insights and new mechanisms



Results of 400 h stability test for Ceramic Hydrogen-permselective Membrane


were identified governing chemical vapour deposition in the complex geometry of multi-layer porous materials.

Since quality ceramic substrates were unattainable from commercial suppliers, CETC-Ottawa produced its own asymmetric ceramic substrates. In the process, key parameters controlling the quality of  $\alpha$ -alumina coating of base tubes were identified. CETC-Ottawa believes these successes constitute a breakthrough in the production of high performance hydrogen-permselective membranes for a variety of applications.

CETC-Ottawa developed and patented a novel technology that converts natural gas to syngas by catalytic partial oxidation or dry reforming ( $\text{CH}_4$  reforming with  $\text{CO}_2$ ) of methane (natural gas) using a hydrogen-permselective membrane reactor.

## Your Invitation to Work with Us

We are interested in collaborating with you. Please contact the Business Office to discuss your particular needs.

 (613) 996-8693

 [cetc-bdo@nrcan.gc.ca](mailto:cetc-bdo@nrcan.gc.ca)

## For Further Information Please Contact:

Dr. Jan Galuszka  
Senior Research Scientist  
Project Leader Ceramic Membrane R&D  
Industrial Innovation Group  
 (613) 995-1585  
 [galuszka@nrcan.gc.ca](mailto:galuszka@nrcan.gc.ca)

CANMET Energy Technology Centre - Ottawa  
Natural Resources Canada  
1 Haanel Drive  
Ottawa, Ontario, K1A 1M1  
Canada

[cetc.nrcan.gc.ca](http://cetc.nrcan.gc.ca)