technology opportunity

Advanced Technology Membrane Reactors for Hydrogen Production

The University of Florida is seeking companies interested in commercializing a novel method of producing hydrogen using proton conducting membranes. These membrane reactors generate hydrogen with both superior efficiency and greater yield than current technology. Currently 17.2 billion pounds of hydrogen is being produced annually in the United States and this will grow dramatically as it is being looked to as a future fuel due to its potential for addressing both climate change concerns and energy independence.

Applications

More efficient production of hydrogen from hydrocarbon feed stocks, including natural gas, coal-based synthesis gas, and biogases

Advantages

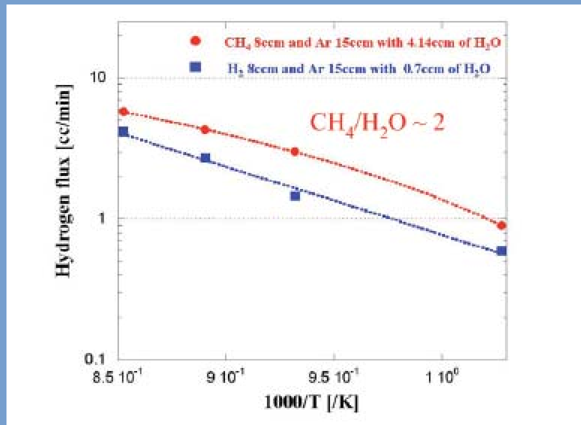
- Couples steam reformation, water-gas-shift, and hydrogen separation in one step, thus reducing process complexity and cost
- Efficiently converts a variety of hydrocarbon feed stocks to hydrogen with increased yield
- Integrated membrane separation produces pure hydrogen
- Membranes demonstrated to have increased chemical stability
- Offers diverse market applications, creating a greater potential for higher profit

Technology

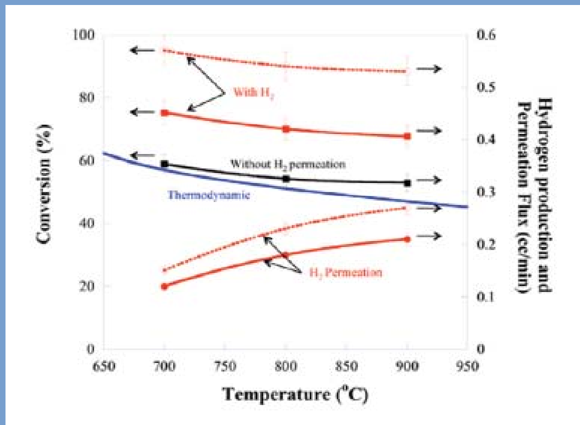
Membrane reactor technology holds the promise to circumvent thermodynamic equilibrium limitations by in-situ removal of product species, resulting in improved chemical yields. Recent advances in mixed-conducting oxide-membrane technology present the possibility for a dramatic reduction in the cost of converting petroleum, coal and biomass derived feed stocks to hydrogen and other "value added" hydrocarbons. UF has developed mixed protonic-electronic conducting materials for use as solid-state dense high temperature hydrogen permeation membranes (protons are hydrogen ions). These membrane materials are perovskite ($SrCe_{1-x}M_xO_3$) based high temperature protonic conductors, and because the hydrogen transport occurs through the crystal lattice infinite H_2 separation selectivity is achieved, resulting in an extremely pure H_2 product.

Technology (Continued)

UF has performed extensive studies on these materials from fundamental materials properties to development of membrane reactors. The membrane reactors are based on thin-film proton conducting membranes on catalyst-impregnated porous tubular supports.



H2 flux obtained with the membrane reactor from-dry/humid H2 and internally steam reformed CH4 feed gases



CO conversion and hydrogen permeation flux through 6" tubular type hydrogen membrane from water gas shift reaction of CO

The Inventors

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