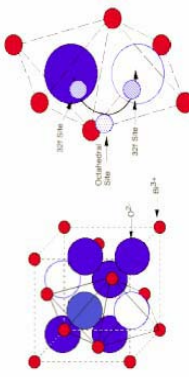


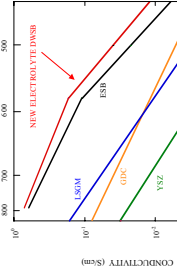


Fundamental Science

Fundamentals of Ionic Transport



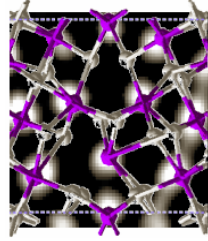
Oxygen-ion transport mechanism



Conductivity of fuel cell electrolytes

- Developed fundamental understanding of ion transport
- Resulting in world record highest conductivity solid oxide electrolyte
- Making even higher performance SOFCs feasible

Advanced Computational Materials Science



Ab-initio calculations of ZrO₂ grain boundaries. Calculated atomic positions (overlying actual measured atomic positions (HRTEM)).

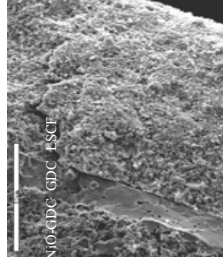
University of Florida – U.S. Department of Energy High Temperature Electrochemistry Center

Mission: Develop fundamental understanding of ionic transport in, and electrocatalytic (electrochemical catalysis) phenomena on the surface of, ion conducting materials.

Research: From first-principles calculations and molecular dynamic simulations of ionic transport and gas-solid interactions to synthesis and characterization (structural, electrochemical and catalytic) of novel ion conducting materials and electrocatalysts.

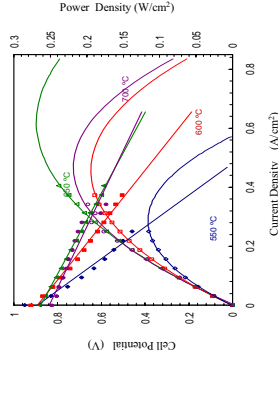
Goal: Minimize the polarization of fuel cells and batteries, maximize the surface exchange coefficient of gas separation membranes and enhance the signal and selectivity of exhaust sensors. In so doing, *improve U.S. energy efficiency and security.*

Fuel Cells

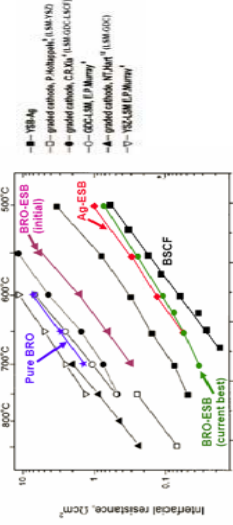


Cross section of UF IT-SOFC

Solid oxide fuel cells (SOFCs) operate on gasoline, diesel, natural gas... AND hydrogen



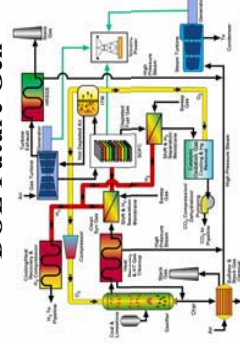
IT-SOFC current-voltage performance



Developing low polarization IT-SOFC Cathodes

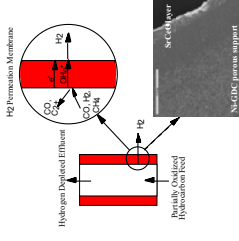
H₂ Production

DOE Future Gen

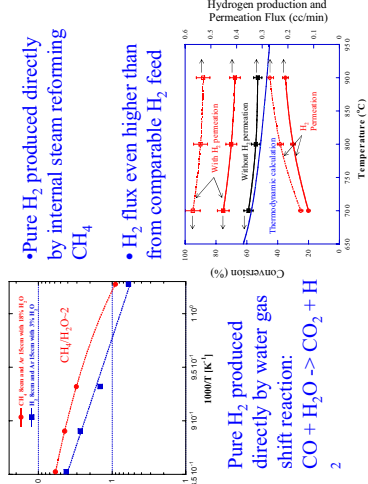


"Hydrogen Production from Fossil Fuels with Proton and Oxygen-Ion Transport Membranes," E. D. Wachsman and M. C. Williams, *Interface*, Volume 13, No.3, Fall 2004

- H₂ permeates selectively through membrane producing pure H₂
- Membranes integrate with reforming and oxidation catalysts
- Fabricating thin film membranes to increase H₂ flux



- Pure H₂ produced directly by internal steam reforming CH₄
- H₂ flux even higher than from comparable H₂ feed

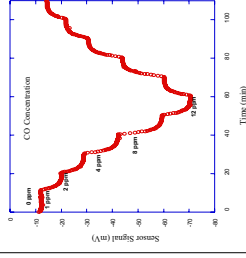
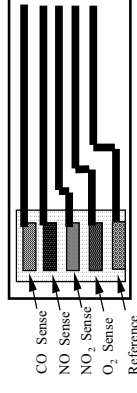


Pure H₂ produced directly by water gas shift reaction:
CO + H₂O → CO₂ + H₂

3% CO and H₂O balance He. Solid lines are H₂O/CO=1, dashed lines are H₂O/CO=2.

Emissions Control

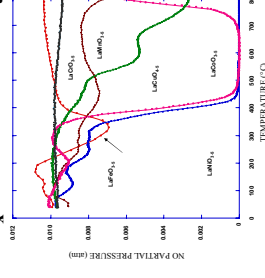
Combustion Exhaust Sensor



- Solid-state NO/NO₂/CO/O₂ sensors based on conventional automotive sensor technology

- Demonstrated 1 ppm resolution
- Demonstrated selective detection

NO_x Reduction Catalysis



Effect of B-site transition metal in LaBO₃ catalysts on NO reduction activity. Temperature programmed reaction of NO over partially reduced catalysts.

For further information contact:
Dr. Eric Wachsman, Director
University of Florida, Gainesville, FL
(352) 846-2991
Email: hwachs@ufl.edu
Web site: <http://htec.mse.ufl.edu>