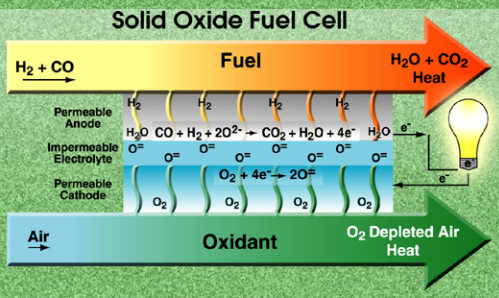
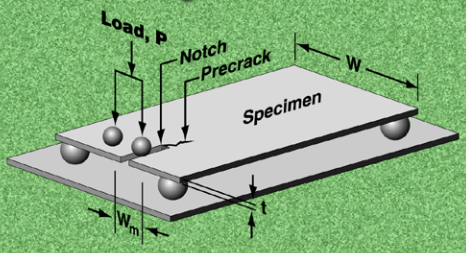
Durability and Reliability of Materials and Components for Solid-Oxide Fuel Cells (SOFC)



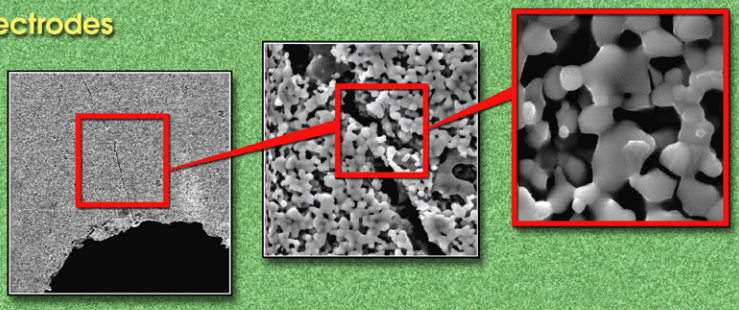
ORNL is participating in the Solid State Energy Conversion Alliance (SECA) Core Technology Program to support the SECA industrial teams in the identification of the mechanisms responsible for the failure of SOFC materials and components. ORNL is also formulating models to predict the reliability and durability of SOFC materials and components. The implementation of such models, which account for the stochastic nature of the mechanical properties of these materials, will lead to the development of more reliable and durable SOFCs

ORNL has characterized SOFC materials (e.g., Ni-based materials for anodes, YSZ electrolytes) to determine the effect of microstructure and geometry on their physical and mechanical properties

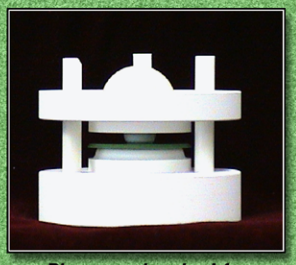
Fracture Toughness of Ni-Based Electrodes



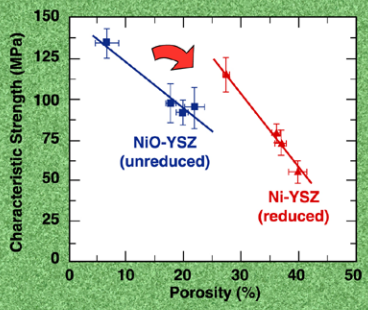
Double-torsion test

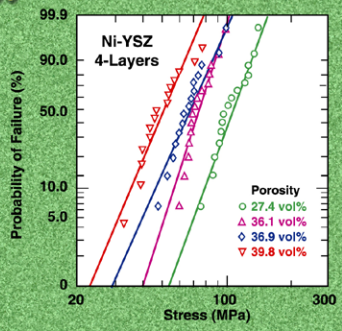


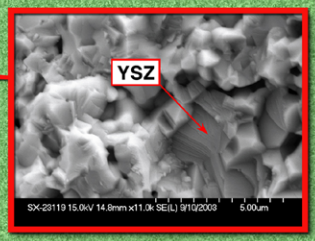
Strength of Ni-Based Electrodes

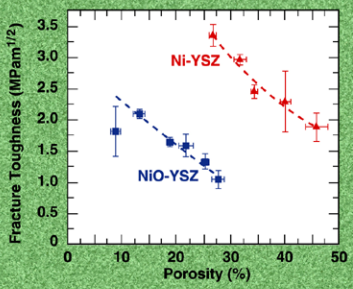


Ring-on-ring test for biaxial strength









- The porosity of NiO-YSZ samples increases after reduction
- The biaxial strength of NiO-YSZ decreases after reduction into Ni-YSZ
- The biaxial strength and fracture toughness of NiO-YSZ and Ni-YSZ decrease with increasing porosity
- Ni-YSZ materials are tougher than their NiO-YSZ precursors

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Oak Ridge National Laboratory