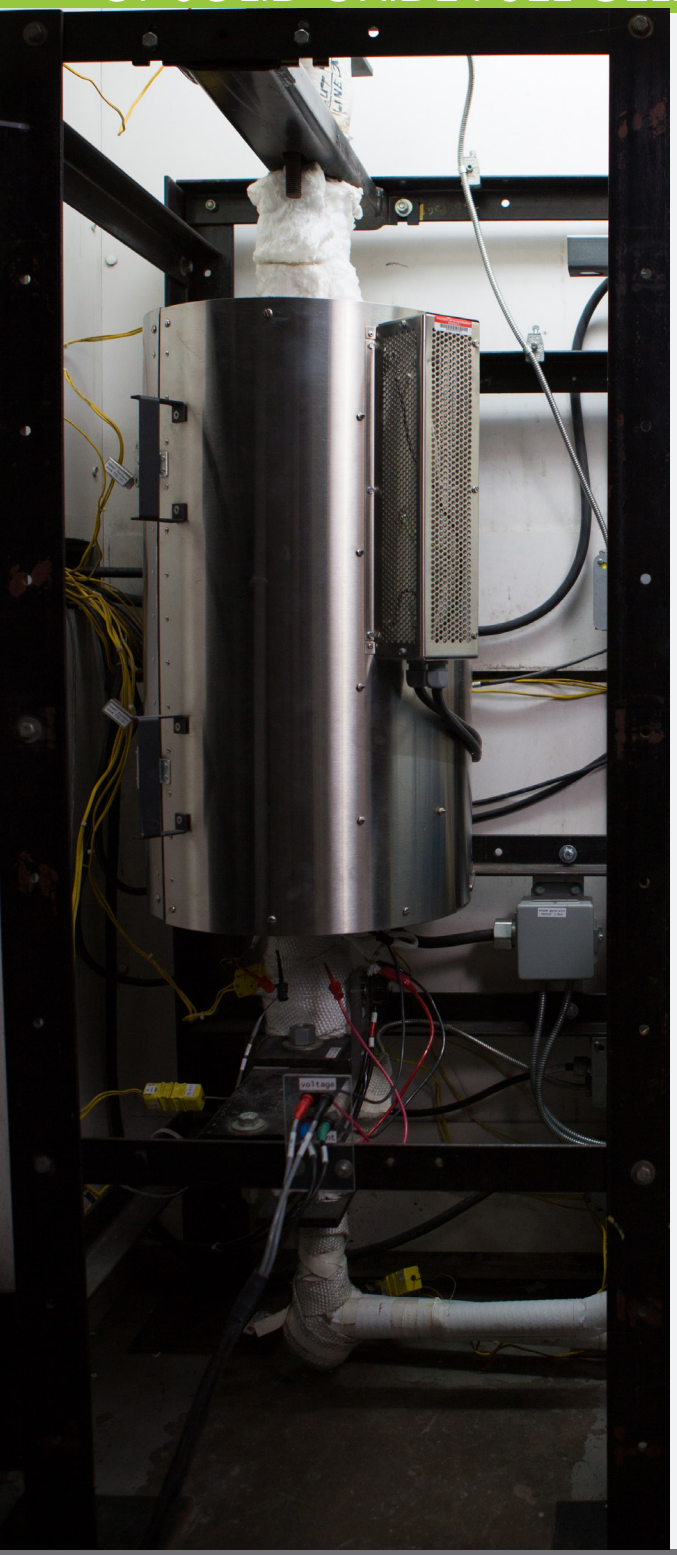
Available for Licensing

NATIONAL ENERGY TECHNOLOGY LABORATORY

HIGH-TEMPERATURE SENSORS FOR MONITORING AND CONTROL OF SOLID OXIDE FUEL CELLS



OPPORTUNITY:

Research is active on the application of embedded optical fiber based sensors to an operational solid oxide fuel cell (SOFC) in conjunction with high-temperature stable distributed interrogation approaches to allow for local monitoring of the absolute value and spatial gradient of the chemical composition and temperature of an anode or cathode stream. This invention is available for licensing and/or further collaborative research from NETL.

OVERVIEW:

Improved efficiencies and lower emissions can be unlocked in current and future generations of fossil fuel based power plants by employing novel embedded sensor technology. These sensors must be able to operate at high temperatures and harsh conditions, and innovations in sensor packaging and design are required to address the embedded sensing needs for these challenging environments.

Advanced functional sensing materials can potentially enable novel devices with improved stability under extreme conditions. This sensor technology focuses primarily on the use of optical fiber based sensors for fuel-utilization monitoring and control in solid oxide fuel cell applications and includes sensor packaging, sensor interrogation, SOFC control methodologies, and application of optical fiber sensors.

The ability to perform real-time embedded sensing in an SOFC is important for operational monitoring and control purposes. By monitoring absolute value and spatial gradient of the gas stream composition and temperature, degradation drivers can be identified and potentially mitigated. In addition, real-time operational measurements would enable the use of active controls for optimizing fuel utilization and minimizing long-term degradation.

SIGNIFICANCE:

- Enables several new real-time active control options to optimize the overall performance and lifetime of the fuel cell
- Provides optical monitoring of fuel gas stream composition and temperature within an operational SOFC
- Allows monitoring of continuous composition and temperature spatial profiles or measuring temperature and gas composition at several discrete points along the length of an operational SOFC

(continued)

- Permits the ability to use the locally measured absolute value of temperature and/or gas composition, and their associated spatial or temporal gradients to optimize operational efficiency, control driving potentials associated with long-term degradation, or to monitor localized failure and degradation in fuel cells

APPLICATIONS:

- Gasification
- Solid oxide fuel cells
- Gas turbines
- Boilers
- Oxy-fuel combustion systems
- Nuclear power generation
- Aviation/aerospace
- Industrial energy efficiency

RELATED PATENTS:

U.S. Patent Pending (non-provisional patent application)

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Title: System and Method for Monitoring a Reactor System Using Optical Fiber-based Sensors

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