



## High Temperature Optical Gas Sensing

### Opportunity

Research is active on optical sensors integrated with advanced sensing materials for high temperature embedded gas sensing applications. Patent applications have been filed for two inventions in this area and several other methods are currently under development. These technologies are available for licensing and/or further collaborative research from the U.S. Department of Energy's National Energy Technology Laboratory (NETL). Organizations or individuals with capabilities in optical sensor packaging for harsh environment and high temperature applications are encouraged to contact NETL to explore potential collaborative opportunities.

### Overview

The availability of fossil fuels to provide clean, affordable energy is essential for domestic and global prosperity and security well into the 21st century. Technologies now under development can make future fossil-fuel-based energy systems dramatically more efficient and cleaner than today's plants, while helping to keep the cost of energy affordable. Innovative control systems can improve efficiency and reduce emissions in advanced fossil-fueled plants, but require novel sensors to measure gas compositions and other conditions inside the processes (embedded sensors) that can operate reliably for long times at high temperatures and in harsh conditions. Optical sensors use light to remotely access internal processes located in harsh environments rather than electrical connections or components.

This series of inventions addresses harsh environment sensing at temperatures above approximately 400-500°C using novel sensing materials that are compatible with optical sensing platforms as well as more conventional resistive platforms. The sensors will use thin films of specialized materials that can be integrated with optical platforms for measurements of chemical composition or other process properties in extreme conditions. An emphasis is currently being placed on development of sensing materials for hydrogen and carbon monoxide detection, but sensors can be potentially designed to measure other gaseous components including oxygen, carbon dioxide, steam, sulfur species and nitrogen species as well as others at high temperatures in energy systems and other applications.

### Patent Details

U.S. Patent Application 13/443,223 filed April 10, 2012;  
Inventors: Paul R. Ohodnicki, Jr. and Thomas D. Brown

U.S. Provisional Patent Application 61/664,886 filed June 27, 2012;  
Inventors: Paul R. Ohodnicki, Jr. and Congjun Wang

### Significance

- New, robust and reliable sensors can enable the highly automated process controls that are needed to optimize the operation and performance of advanced fossil fuel based energy systems.

### Applications

- Harsh environment sensing in energy applications such as gas composition in gasification, oxy-fuel combustion, natural gas processing, fuel cells, gas turbines, and other energy conversion systems.
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- The types of materials currently under development could also be utilized for sensing in environments with similar temperatures and harsh conditions relevant to defense, space science, or industrial manufacturing process monitoring and control.

### Contact

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January 2013