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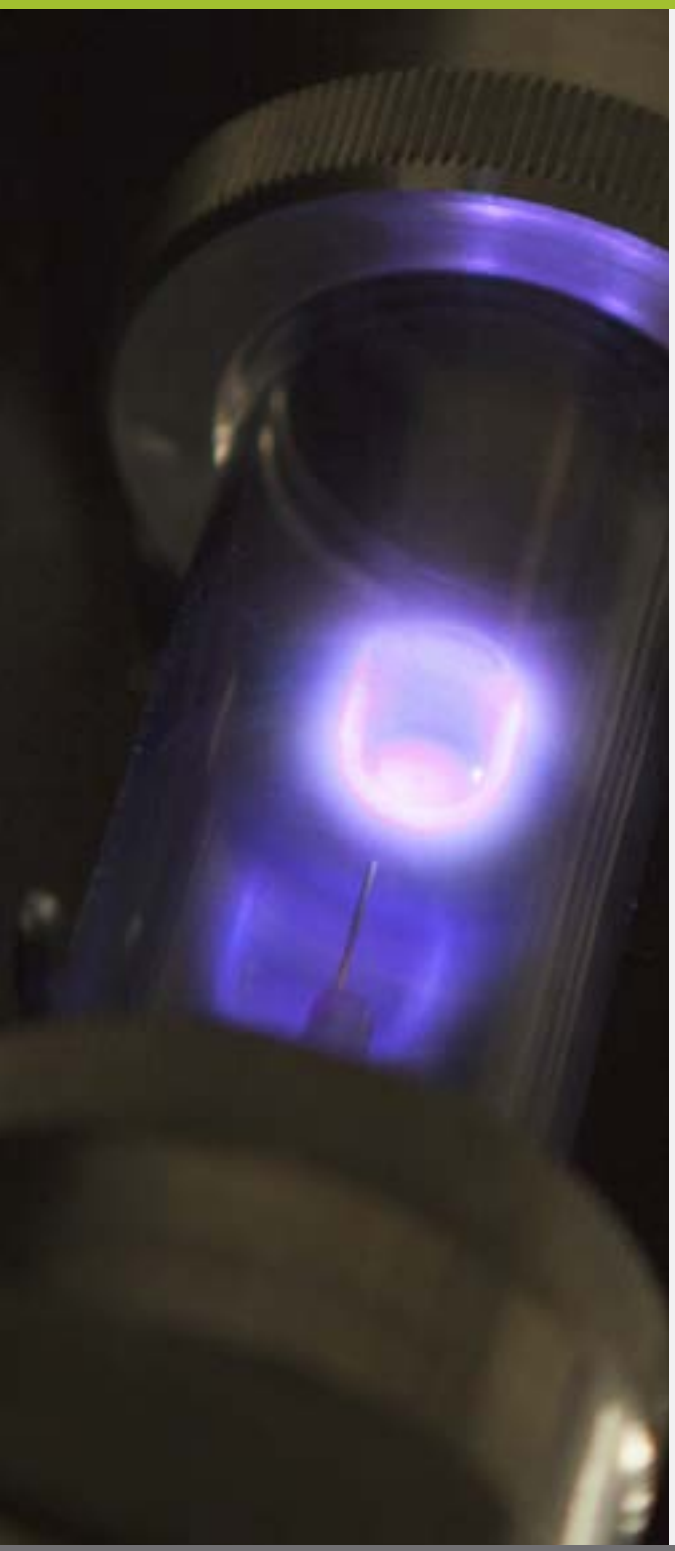
NATIONAL ENERGY TECHNOLOGY LABORATORY

GAS SENSING SYSTEM EMPLOYING RAMAN SCATTERING



OPPORTUNITY:

The Department of Energy's National Energy Technology Laboratory (NETL) is seeking collaborative research partners and/or licensees interested in implementing a patented gas sensing system technology. The patent is jointly owned by NETL and the University of Pittsburgh, with the University handling the licensing. NETL would work with a potential licensee and the University to license the technology.

Described in this patent is a gas analyzing sensor that characterizes gaseous fuel, exhaust gases, or other process gas streams. The sensor reports concentrations of all majority gases to 0.1% in 1 second or less, and can be used for real-time gas analysis and system control. The sensor relies on novel techniques to enhance usually weak spontaneous Raman emissions from the gases being sampled, enabling the application of Raman spectroscopy to rapid gas analysis. The invention provides a gas composition measurement system that is fast, accurate, cost effective, and capable of continuously measuring the concentrations of gases in a mixture such as natural gas, at elevated system pressures.

OVERVIEW:

Industries that utilize natural gas, gasifier syngas, biogas, landfill gas, or any type of fuel gas can benefit from knowing the composition of a fuel gas mixture in real-time. Natural gas, the most common fuel, can have significant variation in hydrocarbon composition in areas supplied by multiple sources. The "opportunity fuels" such as biogas and landfill gases, also have significant variation in quality, and operators often use natural gas as a backup fuel. There is a need for a sensing system that is able to quickly and reliably identify, characterize, and determine the concentration of the various gases in a gas mixture.

(continued)

Principal Investigator:
Ben Chorpening

The current invention meets this need by providing a gas sensor system capable of accurate and continuous readout of the relative mole percent of all major fuel-gas components including H_2, CO, CO_2, CH_4, C_2H_6, and C_3H_8, along with O_2, N_2, and water vapor. The sensor system is based on Raman spectroscopy, and has been developed to utilize low laser powers and low-resolution spectrometers and detectors to reduce cost while giving readouts in 1 second or less. This sensor system will greatly benefit the power industry, as well as other industries utilizing gaseous input or output streams by enabling faster, smarter control to increase process efficiency and reduce emissions. Currently, NETL is testing field prototype sensor systems to demonstrate use in applications and long-term operation.

SIGNIFICANCE:

This gas analyzing sensor system provides the following advantages

- Reports concentrations of all majority gases to better than 0.1% in 1 second or less, and can be used for real-time gas analysis and system control.
- Real-time capability enables turbine operators to switch from one fuel to another with continuous adjustment of the fuel/air ratio for optimum operation efficiency and flameout prevention.
- Current field-unit prototypes are rated for pressures between 10 psi and 800 psi and gas temperatures up to 200° C for regulated or direct pipeline measurement. The high temperature sensing cell also permits direct measurement of water vapor concentration in a fuel gas.

APPLICATIONS:

- Identify and characterize various gases in a mixture or sample
- Natural gas pipeline characterization
- Monitoring and controlling various industrial processes or reactions

RELATED PATENTS AND PATENT APPLICATIONS:

- U.S. Patent No. 8,674,306, issued March 18, 2014, titled “Gas Sensing System Employing Raman Scattering.” Inventors: Steven Woodruff, Joel Faulk, Michael Buric, and Peng Chen

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