



## Distributed Optical Sensor for CO<sub>2</sub> Leak Detection

### Opportunity

Research is active on the technology “Distributed Optical Sensor for CO<sub>2</sub> Leak Detection,” for which a Patent Application has been filed. This technology is available for licensing and/or further collaborative research from the U.S. Department of Energy’s National Energy Technology Laboratory (NETL).

### 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. However, there are concerns over the impacts of greenhouse gases (GHGs) in the atmosphere—particularly carbon dioxide (CO<sub>2</sub>). Carbon capture and storage in geologic formations is a promising technology to reduce the impact of CO<sub>2</sub> emissions on the environment. Monitoring capabilities that are reliable and cost effective are needed to confirm permanent storage of CO<sub>2</sub> in geologic formations. Improved monitoring technologies are needed for surface, near-surface, and subsurface applications to ensure that injection, abandoned, and monitoring wells are structurally sound and that CO<sub>2</sub> will remain within the injection formation.

NETL has developed a CO<sub>2</sub> injection basin leakage detection system using miniaturized laser sensors with optical fibers. The invention will make measurements of elemental content and chemical composition in gases, liquids, and on solids, and will allow the monitoring and reporting of possible CO<sub>2</sub> leaks within the environments of interest. The sensors use two laser-based methods: laser induced breakdown spectroscopy (LIBS) and RAMAN spectroscopy (named for the scientist C. V. Raman). LIBS can be used to measure elemental composition and RAMAN spectroscopy provides a fingerprint by which chemical compounds can be identified. Sensors can be distributed widely either above ground or down hole to monitor for the presence of CO<sub>2</sub> or to detect characteristic changes in the ground water contents that may indicate leakage from a CO<sub>2</sub> injection site.

### Patent Details

A U.S. nonprovisional patent application was filed January 26, 2012.

Inventors: Dustin McIntyre, Steven D. Woodruff and Jinesh Jain

### Significance

- This system would use an all solid state optical system so that the immersion of the device in the temperature and pressure of the down-hole environment will not affect the operation.
- The system eliminates the need for high quality enclosed and thermally insulated pressure cells for keeping the optical systems safe from the extreme environment.

### Applications

- Monitoring ground water quality and air quality to detect leakage of sequestered CO<sub>2</sub> using miniaturized laser sensors.
- Other applications – Airborne security in buildings, water quality security, extreme environment sensing, deep ocean and aquatic environment sensing.

### Contact

NETL Technology Transfer Group

techtransfer@netl.doe.gov

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