

High performance gas sensor for gasification and other harsh environments

Researchers in Prof. Ronald K. Hanson's laboratory have developed a non-intrusive gas sensor designed for high performance temperature and species concentration measurements in high pressure, particulate laden environments. This technology is an adaptation of normalized wavelength-modulation spectroscopy (WMS) detection of diode laser absorption using harmonics of the signal above $2f$ to reduce signal contributions from the background interference. This results in significant improvements at elevated pressure, especially in settings with large background signals such as coal gasification systems. The sensor could also be expanded to include remote monitoring, data collection, or closed loop control.

Stage of Research

The inventors have tested the technology in the laboratory and in the field (coal gasifier). In an environment with less than 0.1% laser transmission due to particulate loading, they have demonstrated gas temperature measurements at 1Hz with better than 5% accuracy at gas pressures exceeding 250 psi.

Applications

- **Gas sensor** - temperature and species concentration measurements for:
 - coal gasification
 - combustion
 - plasma processing/plasma discharge

Advantages

- **Fast, real-time data processing**
- **Small relative WMS background**
- **Non-intrusive** optical measurements in environments with significant particulate - demonstrated in environment with less than 0.1% laser transmission
- **Expandable** to include remote monitoring, data collection, or closed loop control
- **Calibration-free**

Publications

- K Sun, X Chao, R Sur, JB Jeffries, RK Hanson, "[Wavelength modulation diode laser absorption spectroscopy for high-pressure gas sensing](#)" *Applied Physics. B, Lasers and optics* 110 (4), 497-508

Patents

- Published Application: [20140336957](#)
- Issued: [9,939,376 \(USA\)](#)

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