

Detection of Gases and Gas Mixtures by Correlation Spectroscopy

By

J. P. Dakin, M. J. Gunning, and P. A. Chambers
*Optoelectronics Research Centre, University of Southampton,
Southampton, SO17 1BJ*

Abstract:

The reliable detection and monitoring of gases and gas mixtures is known to play a crucial role in many real-world environmental and industrial applications. It is of considerable importance to utilise techniques that are not susceptible to poisoning, are specific to a target gas in a mixture, are unaffected by contaminants, and can be adapted for in-process monitoring. Ever-more stringent requirements in this field dictate a need for ongoing research in this area.

As many common gases exhibit their fundamental optical absorption in the infra-red and visible regions, novel optical absorption methods for the detection of gases and gas mixtures have application in a variety of real-world situations. Of these, correlation spectroscopy^{1,2} is an established non-dispersive technique that is attractive in offering appreciable sensitivity and discrimination for gas detection^{3,4}, with the potential for real-time measurement of different gas species within a mixture using a single sensing instrument.

We present new results for the detection of O₂, CO, and CO₂ gases using a method of real-time correlation spectroscopy involving the modulation of the absorption spectrum of a reference gas sample relative to that of the gas to be measured. We believe it is the first time O₂ has been sensed in this manner and the use of low-cost sources and detectors suggests attractive commercial potential for this device.

References:

1. Goody, R. J. *Opt. Soc. Am.* **58**, 900 (1968).
2. Dakin, J. P. *Advances in Optoelectronics for Environmental Monitoring*, Erice, Sicily, Nov. 1998 (invited).
3. Edwards, H. O. and Dakin, J. P. *Proc. SPIE OE/Fibers Conference 1587*, Paper No. 33, Boston, Sept. 1991.
4. Dakin, J. P., Edwards, H. O., and Weigl, B. H., *Sensors and Actuators B* **29**, 87 (1995).