D I A L
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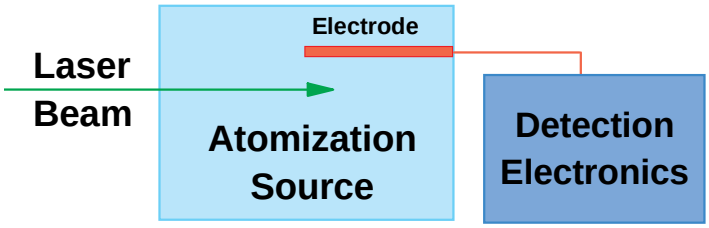
Mercury Detection Using Laser Optogalvanic Spectroscopy

DIAL's Laser Optogalvanic Spectroscopy system (LOGS) can measure in real time the concentration of airborne mercury at concentrations at and below the Environmental Protection Agency's continuous emission monitor (CEM) required detection limits (50 μg/m^3). Currently the LOGS limit of detection is 28 μg/m^3; improvements currently in progress should significantly lower this detection limit.

LOGS is a general purpose system for identifying and monitoring species present at low concentrations. Because LOGS uses electrical rather than optical detection, this technique alleviates the problem associated with monitoring small absorptions or weak fluorescences in the presence of a strong optical background signal, and inherently has greater sensitivity because the collection of charges can be more efficient than the collection of photons. Hence, LOGS has the intrinsic capability to monitor species at lower concentrations than techniques employing optical detection.



DESCRIPTION

In a LOGS experiment, a tunable laser is tuned to an absorption of the species of interest in an atomization source, temporarily increasing the excited state concentration of that species. Because the energy necessary for ionization is less for an excited electronic state than for the ground state, the rate of ionization temporarily increases due to laser-enhanced electron impact ionization:

$$M + h\nu \rightarrow M^*$$

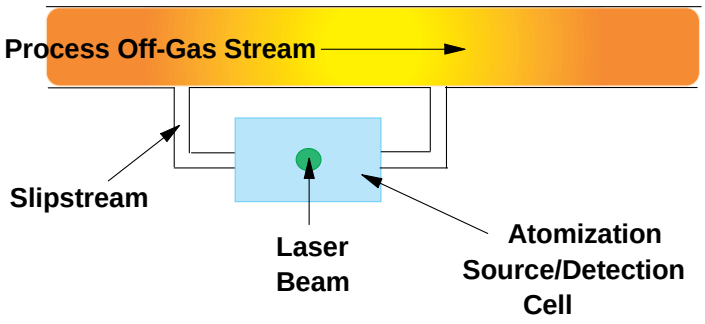
$$M^* + e^- \rightarrow M^+ + 2e^-$$

and/or due to direct laser photoionization:

$$M + h\nu_1 + h\nu_2 \rightarrow M^+ + e^-$$

This process can be monitored as a transient (tens of microseconds) voltage change if a high voltage electrode is inserted into the atomization source. The concentration of the species of interest can be directly related to the magnitude of the LOGS signal.

The concentration of mercury in the off-gas stream is measured in real time by extracting a portion of the off-gases via a slipstream. The sample is atomized and then excited by a laser. After the LOGS signal has been detected, the sample is returned to the off-gas stream.



ON-SITE APPLICATIONS

A prototypical LOGS system is available for on-site demonstrations of LOGS's ability to measure the concentration of mercury in the off-gases of thermal treatment systems. If a customer desires the Logs Mercury Monitor System, DIAL will sell a complete system and will make available upgrades and service.

Additional information about this technique or any other research being conducted at DIAL can be obtained by contacting Dr. David L. Monts at:

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