Tiger Optics 21ST CENTURY SPECTROSCOPY

HCl Continuous Emissions Monitoring

Products: Tiger-i 2000

Tiger Optics Overview

Tiger Optics introduced the world's first commercial "Continuous Wave Cavity Ring-Down Spectroscopy" (CW-CRDS) analyzer in 2001. Today, our instruments monitor thousands of critical points for industrial and scientific applications. They also serve the world's national metrology institutes, where they function as transfer standards for the qualification of calibration and zero gases, as well as research tools for such critical issues as global warming and urban air quality.

CW-CRDS is ideally suited to the requirements of numerous environmental measurement applications, including CEM, where factors such as accuracy, sensitivity, low detection limits, speed of response, long-term stability, low maintenance, and low gas throughput are all essential. This application note details the use of our Tiger-i 2000 HCl unit for CEM applications.

Tiger-i 2000 HCl

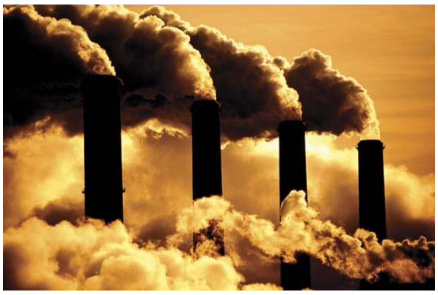
Hydrogen Chloride as a Pollutant

Hydrogen Chloride (HCl) is a major atmospheric pollutant associated with the combustion of fossil fuels, such as coal and heavy oils, and also with a number of manufacturing processes, including cement production. HCl in the atmosphere has an adverse effect on both human health and the wider environment. The inhalation of even low concentrations of HCl can cause irritation of the respiratory tract in healthy individuals and exacerbate symptoms associated with conditions such as asthma and emphysema.

Dissolved HCl is a contributor to acid rain pollution, the results of which include damage to building materials and reduced crop yields. Atmospheric HCl pollution is also a factor in the production of photochemical smog. The economic impact makes the reduction of HCl pollution a priority for regulators and industry.

HCl is generated by multiple industrial processes, with the primary source combustion of coal and oil for household and industrial power generation. Here, chlorides present in the fuels are converted to HCl in the combustion process and emitted with other by-products. In addition, industrial processes emit HCl as a result of chlorides present in raw materials that are converted to HCl during production.

For example, in cement production, raw materials including calcium carbonate, silica, clays, and ferrous oxides, all contain chlorides, resulting in subsequent production of HCl.



Continuous Emissions Monitoring

Regulators worldwide dictate strict emissions limits for many atmospheric pollutants, including HCl. In the US, the Environmental Protection Agency (EPA) is in the process of revising emissions limits to further lessen the impact of the issues described above. These emissions limits require HCl emitters to monitor and report the level of the gas present in stack emissions and to ensure that steps are taken to guarantee that emissions fall below the specified limits. This may require the emitter to either refine their process, via the use of cleaner fuels, for example, or to add abatement apparatus downstream of the industrial process to reduce emitted HCl.

New EPA Regulations

Upcoming changes to EPA regulations will impose the following HCl emissions limits:

Cement kilns	3 ppm
Coal-fired utilities	1 ppm

At the current time, the effective date for these limits are yet to be confirmed, but industry and regulators are preparing for their arrival, with EPA and the Electric Power Research Institute (EPRI) undertaking a series of trials to determine the suitability of several candidate analytical techniques, including CW-CRDS.

Current Analytical Technologies

Current analytical methods for HCl CEM applications include GFC/NDIR, FTIR, and TDLAS. These methods have, to date, been adequate to monitor HCl emissions, based on existing emissions limits. The detection limits for these techniques will not be sufficiently low, however, to meet the revised limits, and so alternative techniques will be necessary.

CW-CRDS offers the performance and range to cope with upcoming regulations, delivering accurate measurements at sufficiently low levels.

CW-CRDS for HCl CEM

Tiger Optics Tiger-i range has been developed for the measurement of trace level gases in samples at ambient pressure, via the use of a vacuum pump to introduce the sample to the analyzer. All Tiger Optics instruments are based on CW-CRDS, as shown in Figure 1 below.

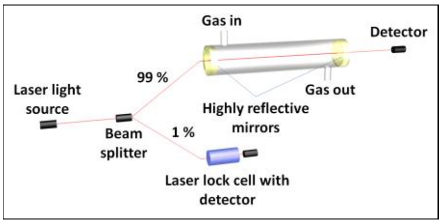


Figure 1. Schematic of CW-CRDS Analyzer

CW-CRDS works by tuning light rays to a unique molecular fingerprint of the sample species. By measuring the time it takes the light to expire or "ring-down", you receive an accurate molecular count in milliseconds. The time of light decay, in essence, provides an exact, non-invasive, and rapid means to detect contaminants.

CW-CRDS Sampling System and Operation

Tiger Optics CW-CRDS analyzers bring significant benefits to CEM applications:

- Accuracy traceable to the world's major national reference labs
- Freedom from interference
- No zero or span required
- No periodic sensor replacement/maintenance
- Nano-second speed of response
- Wide dynamic range

Coupled with a suitable dilution extractive sampling system – either a dedicated system or existing installation – the Tiger-i 2000 is capable of measuring HCl at concentrations in the raw sample gas from low ppb to high ppm. Dilution enables the use of non-heated transfer lines to deliver a clean, cool gas with low particulate concentration to the analyzer. This simplifies the CEM system, improves transport of HCl from the stack to the measurement point, and negates the need for costly heated lines.

The maintenance-free and calibration-free nature of CW-CRDS also affords low cost of ownership and allows users to operate with confidence and ease in the field. And, despite the sophistication and performance associated with this technology; it remains extremely easy to use.

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