Measuring H2S and SO2 in Flue Gas

Applied Analytics Application Note No. AN-033

Application Summary

Analytes: **H_2S** (hydrogen sulfide), **SO_2** (sulfur dioxide)

Detection Technology: **OMA-300 Process Analyzer**

Process Stream: **flue gas**

Typical Range: **0-300 ppm**

Introduction

Power plants and refineries are required to monitor and regulate the flue gas released from the burning of fossil fuels because this gas is released directly into the environment. A certified CEMS (Continuous Emissions Monitoring System) is enormously expensive to implement and maintain, so many operators choose to install affordable emissions analyzers and have the results audited yearly by a government agency.

H_2S and SO_2 are two highly controlled pollutants which are commonly found in flue gas from hydrocarbon fuel combustion. H_2S occurs naturally in many fossil fuel reserves as well as biogas, and oxidizes to SO_2 in combustion. Legal requirements for monitoring the emissions of both chemicals are growing increasingly stringent with increasingly severe punitive measures for exceeding the required limits. As the world energy industry delves deeper into sour gas reserves, the emphasis on regulating these specific emissions is bound to grow.

The OMA system provides fast response measurement of H_2S and SO_2 in the flue gas stream for tight emissions control. Providing excellent detection limits in a solid state package, the OMA is a highly practical solution for a facility that needs reliable emissions monitoring but lacks an astronomical budget for analyzers and maintenance.

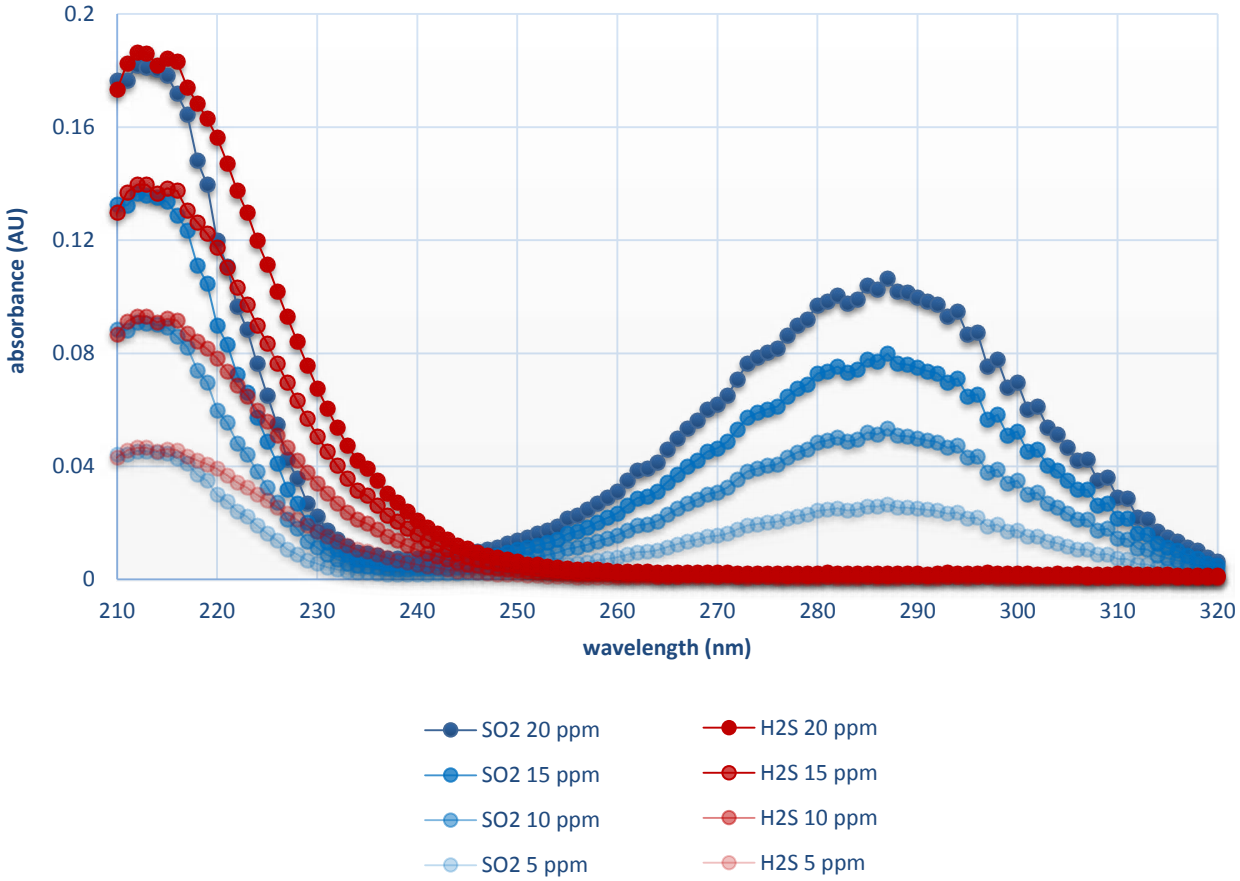
OMA Benefits

- Measures sulfur compound concentration using solid state, consumable-free technology
- Close-coupled sample conditioner provides fast response with easier maintenance than cross-stack
- Scalable measurement allows later addition of analytes and modified concentration ranges
- Decades of field-proven performance in demanding flue gas applications

H_2S and SO_2 Absorbance Curves

Any single photodiode measurement is vulnerable to noise, signal saturation, or unexpected interference. This susceptibility to error makes a lone photodiode data point an unreliable indicator of one chemical's absorbance.

As accepted in the lab community for decades, the best way to neutralize this type of error is to use collateral data in the form of 'confirmation wavelengths,' i.e. many data points at many wavelengths instead of a single wavelength:

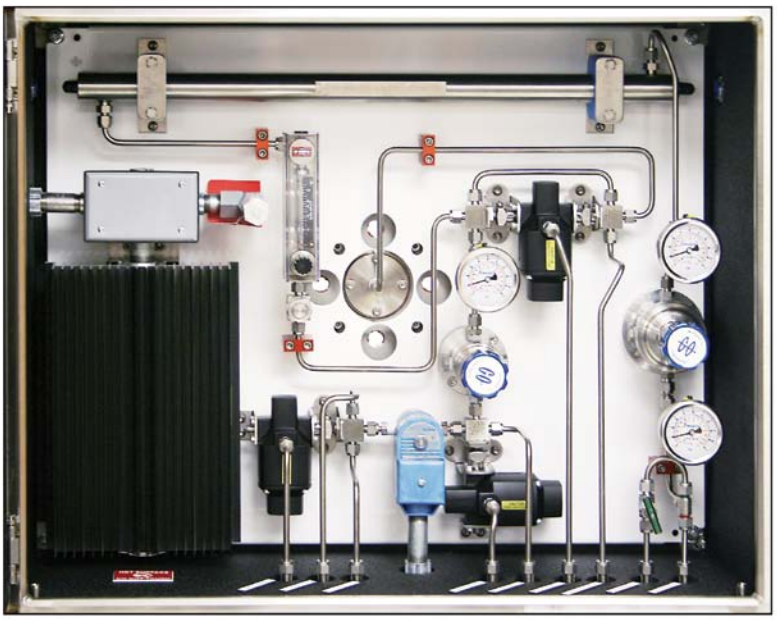


The figures above demonstrates how the OMA 'learns' the absorbance curve structure of each analyte through a full-spectrum calibration on a standard concentration mixture. Using the measurements from each photodiode (each circle in the curve represents a single photodiode providing a data point at an integer wavelength), the OMA knows the expected relation of each point in the absorbance curve and automatically eradicates erroneous results.

This full-spectrum measurement also allows the OMA to easily de-convolute the overlapping absorbance curves of H_2S and SO_2 to accurately isolate the absorbance of each. This capability is unique to spectrophotometers and ensures that there will be no false positive sulfur compound readings, while also preventing cross-interference between the two components.

Close-Coupled Sample Conditioner Design

The OMA flue gas analyzer is paired with a close-coupled sample conditioner which is mounted directly on the stack via a sintered metal probe which extracts the sample. This design has extremely fast response due to the minimal sample route, yet is far easier to install and maintain than a cross-stack method (no issues with optical alignment or span gas validation).



Example system: close-coupled SCS for measuring H_2S in flue gas.

Schematic: close-coupled mounting.

Example Installation: close-coupled OMA system analyzing flue gas at a manufacturing site.

The specifications below represent performance of the OMA-300 Process Analyzer in a typical flue gas application.

For technical details about the OMA-300 Process Analyzer, see the data sheet:
http://www.a-a-inc.com/documents/AA_DS001A_OMA300.pdf

All performance specifications are subject to the assumption that the sample conditioning system and unit installation are approved by Applied Analytics. For any other arrangement, please inquire directly with Sales.

Application Data		
Performance Specifications		
Accuracy	*Custom measurement ranges available; example ranges below.*	
	H_2S	0-10 ppm (@10 bar): ±0.1 ppm 0-10 ppm (@1 bar): ±1 ppm 0-100 ppm: ±1% full scale or 1 ppm* 0-10,000 ppm: ±1% full scale
	SO_2	0-100 ppm: ±1% full scale or 1 ppm* 0-10,000 ppm: ±1% full scale
		*Whichever is larger.

Further Reading

Subject	Location
OMA-300 CEM System Data sheet	http://www.a-a-inc.com/documents/AA_DS001D_OMA300CEM.pdf
Advantage of Collateral Data Technical Note	http://www.a-a-inc.com/documents/AA_TN-202_CollateralData.pdf
Close-Coupled Sample Conditioner Data Sheet	http://www.a-a-inc.com/documents/AA_DS604A_CloseCoupledSCS.pdf

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