SVGA-100 Vacuum Ultraviolet (VUV) Detector Simplifies Streaming Gas Analysis

Gas purity analysis is an important aspect of bulk and specialty gas production, and affects a number of industries including petrochemical, biotech, and electronics manufacture. Understanding the concentration of gases in a mixture and monitoring for the introduction of impurities has often required the use of complex separation and multiple detection methods. Fast sampling is a critical safety requirement in the measurement of highly toxic or explosive compounds.

The SVGA-100 is the world's first streaming gas detector using vacuum ultraviolet (VUV) spectroscopy for real-time quantitative analysis. Most chemical compounds absorb strongly in VUV absorbance wavelength range (120 – 240 nm). Photons in this region can induce electronic transitions in virtually all molecules, especially ground state to excited state transitions such as $\sigma \rightarrow \sigma^*$ and $\pi \rightarrow \pi^*$. The result of being able to collect all of the electronic transition data is that every compound has a unique spectral profile in the VUV. The SVGA-100 is a universal detector with unmatched compound selectivity that is designed for real-time bulk and specialty gas monitoring with no need for prior chromatographic separation.

The SVGA-100 features a multi-port sample selection valve with inputs for up to four gases. The detector software allows for quick toggling between samples (<1 sec), enabling rapid sampling and short analysis times. The ability to monitor gases in real-time presents a unique, high-throughput solution for determining identity and concentration which is unmatched by alternative methods that require multiple detectors and/or long runtimes. Site safety is also significantly improved by being able to quickly analyze highly toxic or explosive compounds with one detector.

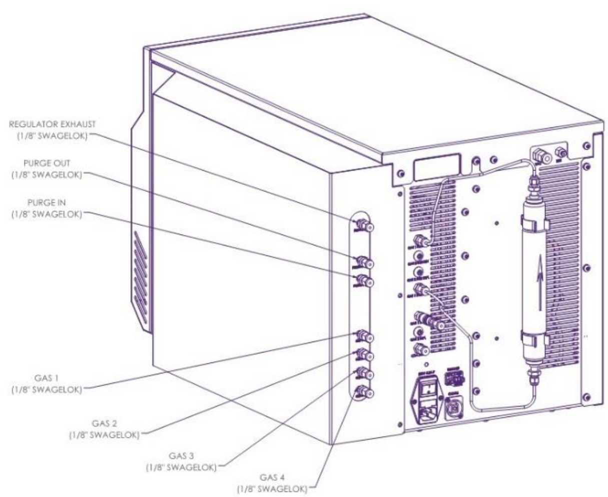

Figure 1: The SVGA-100 streaming gas analyzer utilizes vacuum ultraviolet (VUV) absorption spectroscopy to provide real-time qualitative and quantitative data. The detector features a 4-port sample selection valve for rapid toggling between gas streams.

The continuous gas stream sampling capability enables both immediate process control and improved statistical sensitivity. The absorption cross-section of gas phase molecules in the VUV are hundreds of times stronger than in the infrared (IR). Constant sampling improves the signal to noise ratio (S/N) of VUV detection, resulting in a combined sensitivity advantage of 100 – 1000X over FTIR.

VUV detection is not dependent on large flow cells and signal averaging to acquire strong spectral responses of streamed analytes. VUV energies are also large enough to not be influenced by small temperature fluctuations.

Absorption spectra in the VUV wavelength region are feature rich, allowing for straightforward quantitative determination and spectral deconvolution by the Beer-Lambert Law. VUV spectra are specific to compound chemical structure and provide more accurate analyte identification than error-prone methods that rely on retention time values. The area under the curve of a VUV absorbance spectrum represents the sum of all absorbance spectra collected during a defined time interval. The VUV absorbance of streaming analytes can be easily deconvolved, thus eliminating the need for prior separation. Component concentrations can be reported as mass or volume percent.

Figure 2 shows individual absorbance profiles of three gases overlaid with the results of fitting real-time blended gas spectral data to a model containing only these components. The spectra of oxygen, carbon dioxide, and carbon monoxide were collected separately and added to the spectral library. These compounds had relatively similar concentrations (CO_2 at 275 ppmv, CO at 4.5 ppmv, and O_2 at 11 ppmv) in the blended gas sample that was analyzed in real-time. The fitting algorithm showed good agreement based on the lack of residual spectral data, and the spectra of all three components could be deconvolved due to their distinct spectral differences. The SVGA-100 is ideally suited for real-time gas compound analysis where relatively equivalent concentrations are being used or analytes absorb in different regions of the VUV spectrum.

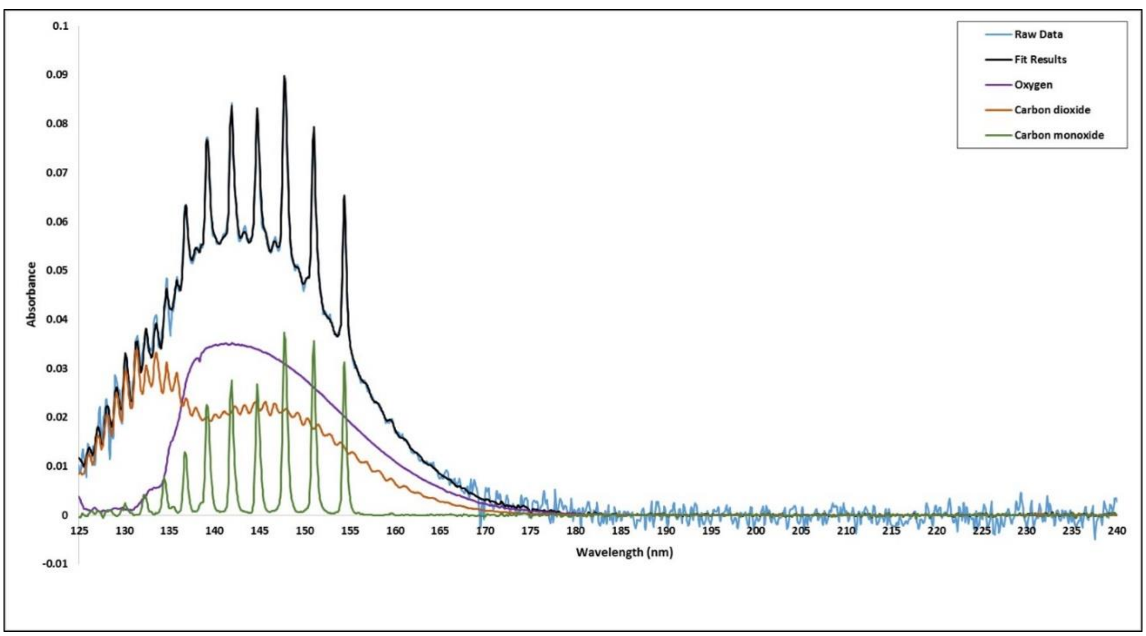

Figure 2: Individual absorbance profiles of oxygen, carbon dioxide, and carbon monoxide overlaid with the results of fitting real-time blended gas spectral data to a model containing only these three components. The model fit is in good agreement, and the spectra of all three compounds can be easily deconvolved to provide % mass composition of each gas mixture component.

VUV ANALYTICS

Parameter	**VUV Analytics SVGA-100**	**Notes**
Light Source	Deuterium lamp	
Wavelength Range	120 - 240 nm	
Wavelength Accuracy	±0.2 nm	
Wavelength Reproducibility	0.05 nm	
Type of Response	Universal	*H_2, He, Ar are tranparent
Spectral Bandwidth	<1 nm	
Maximum Acquisition Rate	100 Hz	
Data Collection Interval	11 ms	
Sample Monitoring Time	Continuous	
Response Characteristic	Identity, Concentration	
Detected Species	All gaseous compounds	*H_2, He, Ar are tranparent
S/N	Typical >10	
Linear Range	4 orders	
Makeup gas	Ar, He, H_2, or N_2	
Destructive?	No	
Flow Cell Dimensions	10 cm pathlength, <80 µL cell volume	<40 µL cell volume option available
Sample Inlets	4 ports	Reference and/or Sample Gas Inlets
Instrument Dimensions	30" x 16.5" x 17", or 76.2 x 42 x 43.2 cm	
Deuterium Lamp Lifetime (hours)	2000	Lamp intensity half life at 250 nm
Weight	120lbs, or 54.4kg	
Power Input Voltage	100/240V	
Power Consumption	<700 VA	
Operating System	Windows 7 Professional SP1, Windows 8.1	
Additional Facilities Requirements	CDA connection 99.999% N_2 connection, 40 mL/min purge requirement	

For more detailed information please visit our website at www.vuvanalytics.com, or contact us at info@vuvanalytics.com.