Application Note

Ammonia measurement in pure ethylene

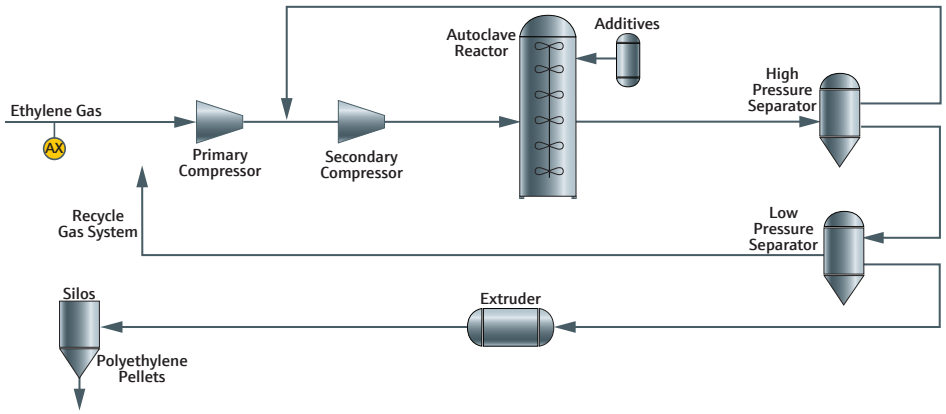
Industry:
Petrochemicals
Application Note 55913

Key Points

- Fast response to NH_3 concentration changes
- Patented* Differential Spectroscopy technique measures NH_3 at sub-ppm levels in ethylene
- Integrated permeation tube supports automated validation checks
- Laser-based measurement is highly selective and accurate for NH_3 in ethylene

*www.spectrasensors.com/patents

Polymer-grade ethylene Catalysts used in polyethylene production processes are highly sensitive to NH_3 and other contaminants that poison and reduce catalyst activity. Ethylene plants utilize molecular sieves and adsorbents to remove polar contaminants (H_2O and NH_3) from ethylene to achieve polymer-grade specifications.



Low Density Polyethylene (LDPE) Production Process

Critical purity measurement Polymer-grade ethylene has stringent specifications for NH_3 content which is measured in ethylene production plants and at custody transfer points. Pipeline specifications for high purity ethylene set the maximum NH_3 concentration at <0.25 ppm. Out-of-spec ethylene may be rejected by polyethylene plants, or sent to flare incurring high costs.

SpectraSensors' solution SpectraSensors tunable diode laser absorption spectroscopy (TDLAS) analyzers have proven highly effective for this critical measurement. TDLAS analyzers have an exceptionally fast response to changes in NH_3 concentration, an important performance characteristic for monitoring ethylene purity at custody transfer points and in the feed streams to LDPE, LLDPE, and HDPE polymer plants. SpectraSensors' patented differential spectroscopy technique enables detection and quantitation of sub-ppm levels of NH_3 in ethylene. An integrated permeation tube supports automated validation checks to verify the analyzer is operating properly during extended periods of time when NH_3 is not present in an ethylene gas stream. Laser and detector components are isolated and protected from process gas and contaminants avoiding fouling and corrosion and ensuring stable long-term operation and accurate measurements in the field.

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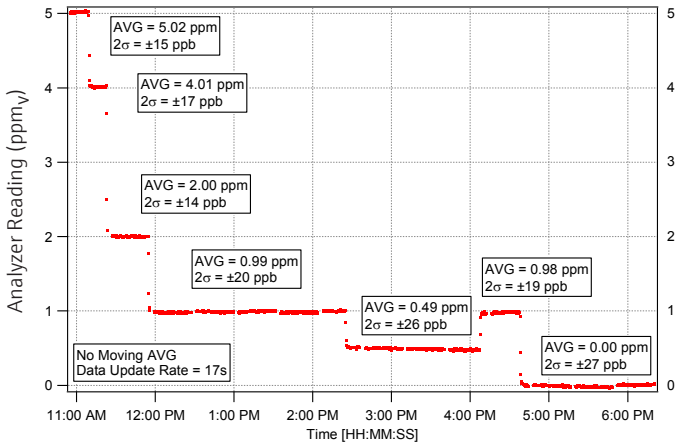
Application Data	
Target Component (Analyte)	Ammonia in Pure Ethylene
Typical Measurement Range	0-5 ppm
Typical Repeatability	±0.04 ppm
Measurement Response Time	1 to ~60 seconds
Principle of Measurement	Differential Tunable Diode Laser Absorption Spectroscopy (NH_3 scrubber included)
Validation	Integrated Permeation System

Typical Background Stream Composition

Component	Unit	Typical Concentration	Min for Application	Max for Application
Ethylene (C_2H_4)	mol%	99.95	99.9	100
Acetylene (C_2H_2)	ppm_v	<1	0	5
Ammonia	ppm_v	<1	0	5
Carbon Monoxide (CO)	ppm_v	0.5	0	3
Carbon Dioxide (CO_2)	ppm_v	<1	0	5
Hydrogen (H_2)	ppm_v	<1	0	5
"Light Inerts" (C_1+C_2+N_2)	ppm_v	100-200	0	1000
Propylene (C_3H_6)	ppm_v	3000	0	10
Total	mol%	100		

The background stream composition must be specified for proper calibration and measurement performance. Specify the normal composition, along with the minimum and maximum expected values for each component, especially NH_3, the measured component. Other stream compositions may be allowable with approval from SpectraSensors.

Step test NH_3 in ethylene The accompanying graph shows results of a Step test in which the concentration of NH_3 was decreased from 5 ppm down to 0 ppm. Measurement repeatability at all concentrations is well within specifications (±40 ppb).



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