Application Note

Ammonia measurement in pure propylene

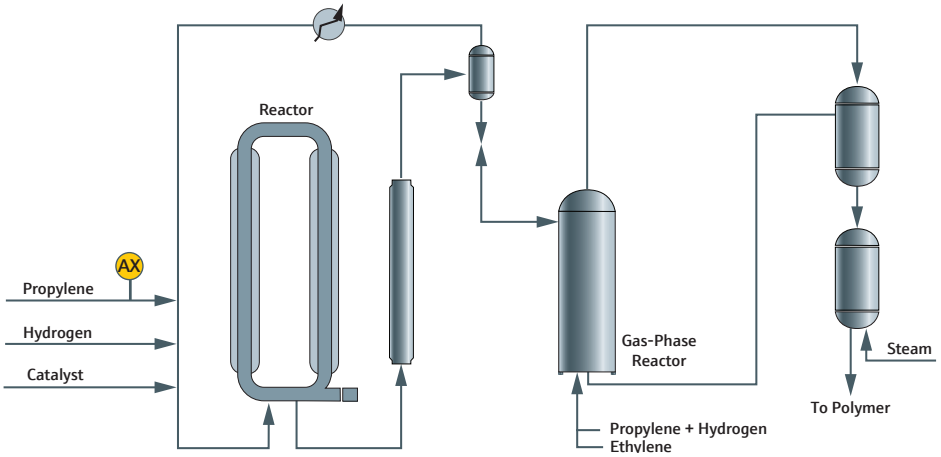
Industry:
Petrochemicals
Application Note 55113

Key Points

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

*www.spectrasensors.com/patents

Polymer-grade propylene Catalysts used in polypropylene polymerization process are highly sensitive to NH_3 and other contaminants that poison and reduce catalyst activity. Purity specifications for polymer-grade propylene are very stringent. The maximum allowable NH_3 concentration for some polymerization processes is <1 ppm_v.



Propylene Production Process

On-line NH_3 measurement On-line monitoring ensures the NH_3 content of polymer-grade propylene is within specifications for its intended use. Out-of-spec propylene may be rejected by polypropylene plants, require additional treatment steps, 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 propylene purity in product plants and at custody transfer points in feed streams to polymer plants. SpectraSensors patented differential spectroscopy technique enables detection and quantitation of sub-ppm levels of NH_3 in propylene. An integrated permeation tube supports automated validation checks to verify the analyzer is operating properly during the extended periods of time when NH_3 is not present in a propylene stream. Laser and detector components are isolated and protected from process gas and contaminants avoiding fouling and corrosion and ensuring stable long term operation.

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Application Data	
Target Component (Analyte)	Ammonia in Pure Propylene
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

*Consult factory for alternate ranges.

Typical Background Stream Composition

Component	Unit	Typical Concentration	Min for Application	Max for Application
Propylene (C_3H_6)	Wt. %	99.75	99.5	100
Ammonia (NH_3)	ppm_v	<1	0	0.5
Ethylene (C_2H_4)	ppm_v	50	0	100
Ethane + Propane (C_2H_6 + C_3H_8)	Wt. %	0.25	0	0.5
Diolefins + Acetylenes	ppm_v	<10	0	25
Carbon Monoxide (CO)	ppm_v	<10	0	30
Carbon Dioxide (CO_2)	ppm_v	<1.0	0	2
Oxygen (O_2)	ppm_v	<1	0	2
Water (H_2O)	ppm_v	<2	0	2
Total	Mol. %	100		

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