

Application Note

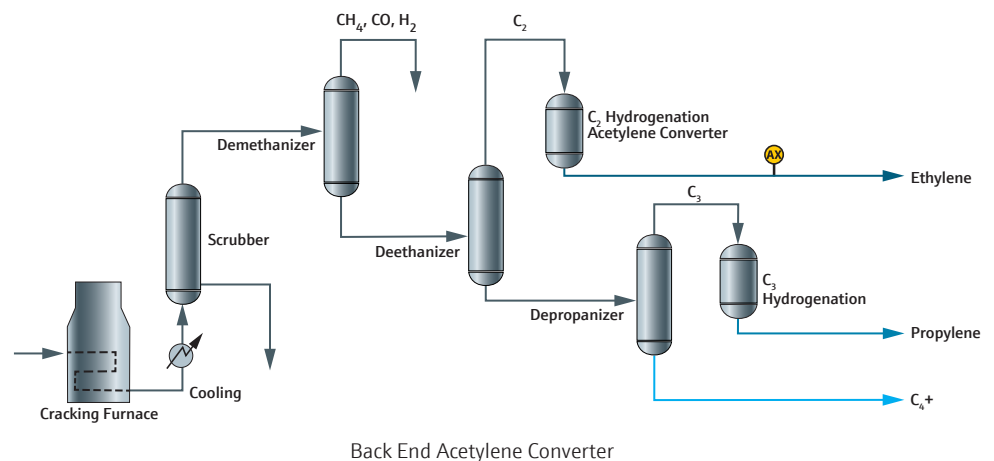
Acetylene measurement at the outlet of back end acetylene converters

Industry:
Petrochemicals
Application Note 54711

Key Points

- Extremely fast response to C_2H_2 concentration changes
- Laser-based measurement is highly selective and accurate for C_2H_2 in ethylene
- Non-contact laser measurement avoids fouling and corrosion for reliable long-term operation
- Low maintenance and OPEX costs – no cylinders of carrier gas or other consumables

Ethylene purity Separating acetylene (C_2H_2) from ethylene (C_2H_4) is difficult due to the similar volatility of these gases. A catalytic hydrogenation reaction step is typically employed to convert acetylene into ethylene. The concentration of C_2H_2 is reduced from thousands of ppm at the inlet of an acetylene converter to hundreds of ppm at the mid-bed down to low ppm or ppb levels at the outlet of the converter.



Acetylene measurement Monitoring the acetylene concentration in ethylene exiting an acetylene converter ensures the conversion process is operating efficiently and ethylene purity specifications are being met. The typical measurement range for C_2H_2 at the outlet of an acetylene converter is 0-5 ppm_v. Out-of-spec ethylene may be sent to flare to avoid contamination and shutdown of downstream equipment and the high cost of such incidents.

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 acetylene concentration, an important performance characteristic for monitoring ethylene purity exiting an acetylene converter. Laser and detector components are isolated and protected from process gas and contaminants avoiding fouling and corruptions and ensuring stable long-term operation.

Application Data

Target Component (Analyte)	AC ₂ H ₂ Outlet of Back End Acetylene Converter
Typical Measurement Range	0-5 ppm*
Typical Repeatability	±0.1 ppm*
Measurement Response Time	1 to ~60 seconds*
Principle of Measurement	Non-Differential Tunable Diode Laser Absorption Spectroscopy
Validation	A certified blend of C ₂ H ₂ in a balance that matches the sample

*Application specific; consult factory.

Typical Background Stream Composition

Component	Unit	Typical Concentration	Min for Application	Max for Application
Acetylene (C ₂ H ₂)	ppm _v	0-5	0	10
Ethylene (C ₂ H ₄)	mol%	65	60	90
Ethane (C ₂ H ₆)	mol%	33	0	40
Hydrogen (H ₂)	ppm _v	0-50	0	1000
Carbon Monoxide (CO)	ppm _v	0.5	0	1000
Carbon Dioxide (CO ₂)	ppm _v	<1.0	0	1000
Methane (CH ₄)	ppm _v	50 - 100	0	1000
Propylene (C ₃ H ₆)	ppm _v	3000	0	5000
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 acetylene, the measured component. Other stream compositions may be allowable with approval from SpectraSensors.

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