

Application Note

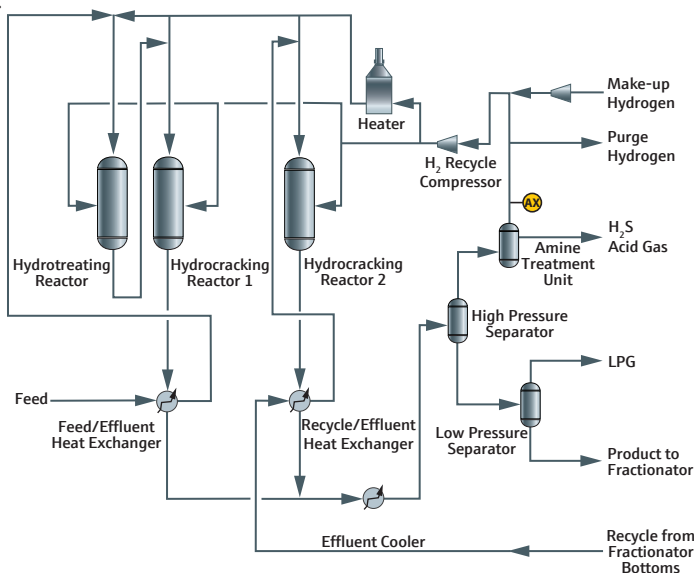
H₂S in amine treatment unit outlet hydrogen recycle gas

Industry:
Refining
Application Note 20402

Key Points

- Fast response to H₂S concentration changes for process monitoring and control
- Laser-based measurement is highly selective and accurate for H₂S in hydrogen recycle gas
- Non-contact laser measurement avoids detector contact, corrosion and damage from H₂S and other contaminants
- Low maintenance and OPEX costs – no cylinders of carrier or combustion gases, UV lamps, or lead acetate tape

Hydrodesulfurization Refers to catalytic processes (hydrotreating and hydrocracking) that use hydrogen to remove sulfur from naphtha feed to protect the platinum/rhenium catalyst in catalytic reformer units, and from vacuum gas oil and residuum feeds to fluid catalytic cracking units (FCCU) to reduce SO₂ levels in FCCU flue gas. Hydrotreating is also used to remove sulfur compounds from gasoline, diesel fuel, kerosene, jet fuel, and fuel oils to reduce SO₂ emissions from combustion of these fuels to comply with ultra-low sulfur fuel regulations.



Refinery Hydrodesulfurization System

On-line H₂S monitoring In operation, liquid feed and hydrogen pass through a reactor packed with catalyst where sulfur compounds are converted to H₂S. Effluent from the reactor is cooled and sent to a high pressure separator, which separates liquid hydrocarbons from a gaseous mixture of hydrogen and H₂S. The hydrogen gas stream is sent to an amine treatment unit to remove H₂S before it is recycled to the process. The H₂S concentration in gas exiting the amine treatment unit is monitored to ensure the scrubbing process is efficiently removing H₂S from the hydrogen before it is recycled and combined with make-up hydrogen.

SpectraSensors' solution SpectraSensors tunable diode laser absorption spectroscopy (TDLAS) analyzers have proven highly effective in this critical measurement. TDLAS analyzers have an exceptionally fast response to changes in H₂S concentration, an important performance characteristic for monitoring the efficiency of the amine treatment unit and quality of hydrogen being recycled to the hydrodesulfurization process. Laser and detector components are isolated and protected from the process gas and entrained contaminants, avoiding fouling and corrosion and ensuring stable long-term operation and accurate measurements in the field.

Application Data

Target Component (Analyte)	Hydrogen Sulfide in Amine Treatment Unit Outlet Hydrogen Recycle Gas
Typical Measurement Range	0-50 ppm, 0-100 ppm, 0-200 ppm*
Typical Repeatability	±1 ppm
Measurement Response Time	1 to ~60 seconds*
Principle of Measurement	Tunable Diode Laser Absorption Spectroscopy
Validation Gas	Certified blend of H ₂ S in Nitrogen

*Consult factory for alternate ranges.

Typical Background Stream Composition

Component	Minimum (Mol%)	Typical (Mol%)	Maximum (Mol%)
Hydrogen (H ₂)	70	85	98
Methane (C ₁)	2	10	15
Ethane (C ₂)	<1	8	8
Propane (C ₃)	<1	1	3
Butanes (C ₄)	<1	<1	1
C ₅ +	0	0	<1

The background stream composition must be specified for proper assessment, calibration, and measurement performance. Specify the normal composition, along with the minimum and maximum expected values for each component, especially H₂S, the measured component. The composition of a hydrogen recycle gas stream may vary based upon the hydrotreater/hydrocracker unit process design and feed.