

Application Note

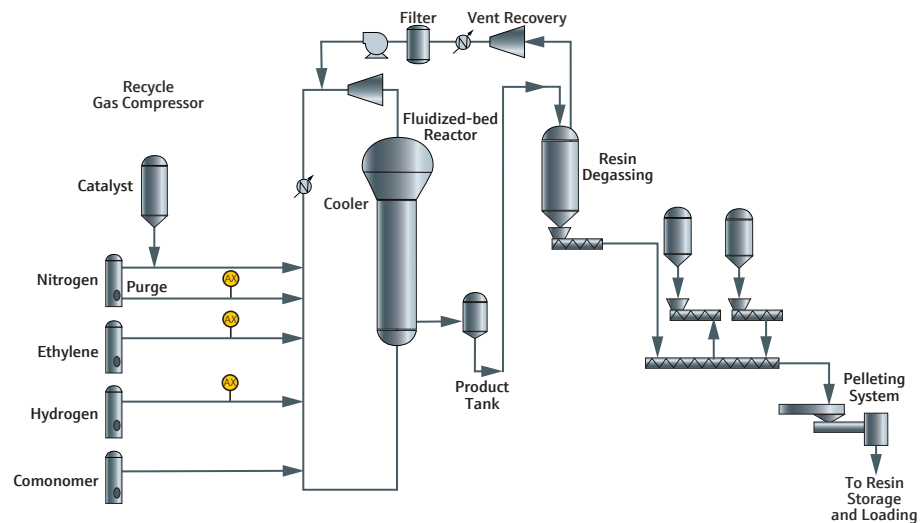
H₂O in UNIPOL™ PE process ethylene feed gas

Industry:
Petrochemicals
Application Note 57901

Key Points

- Exceptionally fast response to H₂O concentration changes
- Patented* Differential Spectroscopy technique measures H₂O at sub-ppm_v levels in ethylene
- Integrated permeation tube supports automated validation checks
- Laser-based measurement is highly selective and accurate for H₂O in ethylene

The UNIPOL™ polyethylene process is a gas phase polymerization process that utilizes high activity metallocene catalyst in a fluidized bed reactor. Ethylene monomer contains residual impurities from the steam cracking process (C₂H₂, CO, O₂, and H₂O) that will poison metallocene catalysts. For this reason, polymer-grade ethylene is passed through a series of adsorbent beds before it is introduced into a UNIPOL™ fluidized bed reactor.



UNIPOL™ Gas Phase Polyethylene Process

On-line H₂O measurement Polymer-grade ethylene undergoes molecular sieve dehydration to reduce the moisture content to sub-ppm levels. On-line monitoring of H₂O in the ethylene exiting molecular sieve dryer vessels prevents gas with elevated levels of H₂O from being introduced to the UNIPOL™ reactor and deactivating the catalyst. The H₂O concentration in the other reactor purge and feed gases (N₂, H₂, and co-monomer) must also be monitored and controlled to protect the catalyst.

SpectraSensors' solution SpectraSensors tunable diode laser absorption spectroscopy (TDLAS) analyzers have proven effective in this critical measurement. TDLAS analyzers have an exceptionally fast response to changes in H₂O concentration, an important performance characteristic for detecting breakthrough in molecular sieve dryer beds and preventing ethylene with elevated levels of H₂O from entering a UNIPOL™ reactor. SpectraSensors patented* differential spectroscopy technique enables detection and quantitation of sub-ppm_v levels of H₂O in ethylene. An integrated permeation tube supports automated validation checks to verify the analyzer is operating properly during the extended periods of time when H₂O is not present in the ethylene feed gas.

*www.spectrasensors.com/patents

Application Data

Target Component (Analyte)	H ₂ O in UNIPOL™ PE Process Ethylene Feed Gas
Typical Measurement Range	0-10 ppm
Typical Repeatability	± 0.020 ppm or 2% of reading
Measurement Response Time	1 to ~60 seconds
Principle of Measurement	Differential Tunable Diode Laser Absorption Spectroscopy (H ₂ O dryer included)
Validation	Integrated Permeation System

Typical Background Stream Composition

Component	Minimum (Mol%)	Typical (Mol%)	Maximum (Mol%)
Ethylene (C ₂ H ₄)	99.95	99.9	100
Water (H ₂ O)	0	< 1 ppm	1 ppm
Acetylene	0	0.5 ppm	< 1 ppm
Carbon Monoxide	0	0.5 ppm	< 1 ppm

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