AMETEK®
PROCESS INSTRUMENTS

APPLICATION NOTE

MONITORING THE FURNACE DECOKING PROCESS IN ETHYLENE PRODUCTION

Carbon Monoxide and Carbon Dioxide Measurements with Tunable Diode Laser Absorption Spectroscopy (TDLAS) in the Furnace Decoking Process

In ethylene production, a hydrocarbon feed stream mixed with steam enters a tubular reactor where, under controlled conditions, the feedstock is cracked at 800 to 850°C (1472 to 1562°F) into smaller molecules within 0.1 to 0.5 seconds. This process takes place in the radiant coils of the furnace.

Cracking of the feedstock in the pyrolysis reactor causes carbon build-up on the radiant coils and tube walls of quench exchangers. As coke builds up, the efficiency of heat transfer from flue gases to hydrocarbons in the tubes of the furnace goes down. In addition, coke deposition causes a pressure drop in the tubes of the radiant coils and transfer line exchangers; this reduces throughput.

MAXIMIZING FURNACE RUN TIME BY MINIMIZING DECOKING TIME

Cracking furnaces need to be decoked once the furnace coils get coated with carbon and lose efficiency. The furnace is taken off-line, the residual hydrocarbons are purged downstream with steam, and the process flow is rerouted to a special decoking system. Producers want to maximize their furnace run time and minimize the time spent decoking the furnaces.

Process gas chromatographs (GCs) can be used to measure the carbon monoxide (CO) and carbon dioxide (CO_2) in ethylene furnaces. However, most process GCs require a temperature-controlled shelter, a robust sample conditioning system, a carrier gas, and GCs can take several minutes to separate the analytes of interest from other components present in the gas stream.

MONITORING THE DECOKING PROCESS WITH A TDLAS-BASED ANALYZER

TDLAS technology has been applied to a number of applications and is widely accepted in hydrocarbon operations for the measurement of moisture, CO_2 and hydrogen sulfide, from percent levels down to single-digit parts-per-million (ppm) concentrations.

The key attributes of a TDLAS-based analyzer are: no lag time, no consumables and a high reliability due to the long life of the solid-state lasers. When looking for cost-effective solutions to monitor the furnace decoking process in ethylene furnaces, a TDLAS-based analyzer is an excellent selection.

WHY AMETEK?

The AMETEK 5100HD TDLAS analyzers have features well suited for petrochemical process applications and variable process conditions.

The 5100HD oven is heated up to 150°C (302°F) and can analyze multiple streams and/or components. Unlike other analyzers, the 5100HD continuously verifies optical system performance, using a sealed reference cell. If required, the laser module can be changed in the field in less than one hour. Products from other TDLAS suppliers must be returned to the factory for this type of repair.

The 5100HD analyzer can also be installed outside of a temperature-controlled shelter, further reducing installation and operational costs.

KEY BENEFITS:

- Field-proven in ethylene operations
- On-line verification (CO and/or CO_2 reference cell) assures the optical system is performing accurately
- No expensive sample system requirements – hot/wet analysis
- True process TDLAS analyzer with liquid separator and horizontal cell built into 0 to 150°C (32 to 302°F) oven.
- Low maintenance: no consumables – no carrier gas, no columns, no column valves
- IP-65 design, walk-in shelter not required.
- Suitable for an ambient temperature range of -20 to 50°C (-4 to 122°F)

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