Application Note

Fluid Catalytic Cracking Unit Regenerator Off Gas for Trace CO and CO_2

Key Features

- ***Avoids damage to the sensor from other components in the stream***
- ***Virtually maintenance free operation – no routine service needed***
- ***Rapid response to process changes: no wet-up or dry-down times***

Fluid Catalytic Cracking (FCC) is an important refining process for the production of "light" products – for example, LPG, diesel, and gasoline – from heavier, crude gas oils.

Cracking takes place using a zeolite-based catalyst that is very active causing an immediate chemical reaction when it is mixed with the feed stream (see Figure 1). During the "cracking" of larger molecules into smaller molecules , carbon forms on the catalyst surface and immediately de-activates the catalyst.

In the reactor, the catalyst is separated from the vapor by the use of cyclones. The oil vapors flow to the top of the reactor once the vapor/catalyst enters and the spent catalyst moving to the bottom. The spent catalyst is carried into the Regenerator by regeneration air (in some cases air plus oxygen). In the regenerator, coke is burned off the catalyst, preparing the catalyst for the next cycle and providing the necessary heat energy to sustain the Regeneration of the catalyst.

In order to ensure that the catalyst is properly cleaned in the Regenerator, an important step is to measure the off-gases leaving the regenerator. By monitoring the ratios of carbon monoxide (CO) and carbon dioxide (CO_2), one can make certain that the catalyst is fully cleaned from accumulated carbon.

Current Solutions

Until recently, contemporary solutions have been with gas chromatographs or infrared analyzers. However, these are complicated and high-maintenance analyzers which lead to high operating costs and uncertain measurements.

Our Approach

Now there is a far more advanced and reliable method to monitor CO and CO2 using Tunable Diode Laser (TDL) gas sensors from SpectraSensors, Inc.

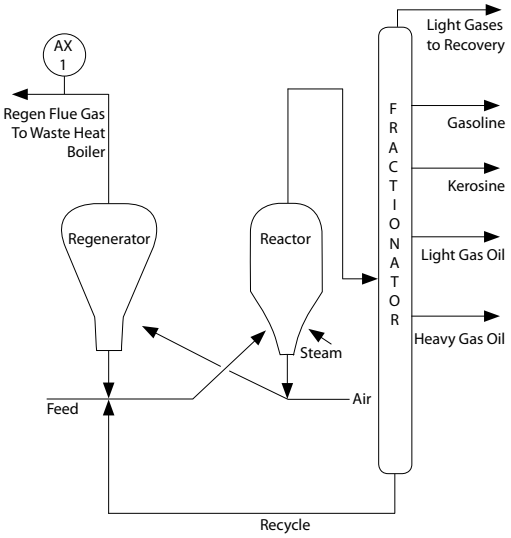

Figure 1. Flow diagram of FCC Unit

Because the laser system never comes into contact with the contaminants present in the regenerator off-gas, the TDL-based gas analyzer practically eliminates maintenance and operational costs. The SpectraSensors SS2200 dual cell unit provides continuous measurement of both CO and CO_2.

For this application, the main challenge is the sample system design. The design must deal with the high levels of catalyst fines that leave the regenerator off-gas. These catalyst fines must be removed without cooling the sample. Otherwise, the catalyst fines will solidify with the liquid water. Fortunately, there have been a number of "self-cleaning" filter probes that have been developed over the years specifically for this application

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