Application Note

Fluid Catalytic Cracking Unit Regenerator Off Gas

Key Features

- *Avoids damage to the sensor from other components in the stream*
- *Virtually maintenance free operation with no routine service needed*
- *Responds quickly to process changes: no wet-up or dry-down times*
- *See product datasheet for more details*

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). Once the "cracking" of larger molecules into smaller molecules occurs, carbon forms on the catalyst surface and immediately de-activates the catalyst.

When the mixture enters the reactor, steam is introduced so as to strip oil that may be clinging to the catalyst. This causes the catalyst to flow in a fluid-like manner; hence the name Fluid Catalytic Cracking. The catalyst is vapor, and once cracked, the oil vapors flow to the top of the reactor with the spent catalyst moving to the bottom. The spent catalyst then flows into a fluidized air regenerator where air (in some cases air plus oxygen) is used to burn off the coke and also provide the necessary energy for the next reaction cycle.

In order to ensure that the catalyst is properly cleaned in the regenerator, a 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 of the carbon that has accumulated on it.

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.

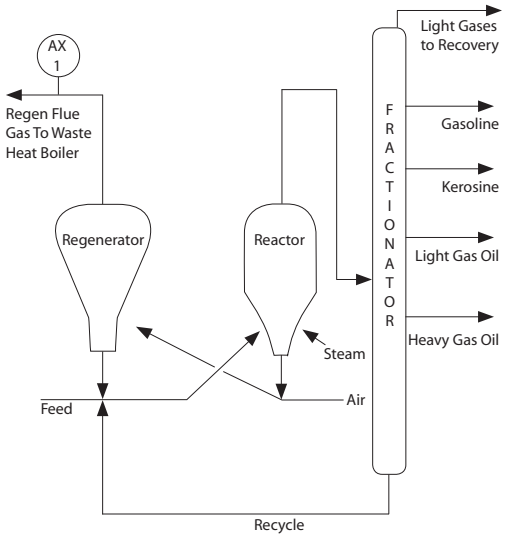

Figure 1: Flow diagram of FCC Unit

Our Approach

Now there is a far more advanced and reliable method to monitor CO and CO_2 using Tunable Diode Laser (TDL) gas sensors from SpectraSensors, Inc. 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.

972 N. Amelia Avenue | San Dimas, CA 91773 | Tel: 800 619-2861 | Fax: 909 542-0402 | **www.spectrasensors.com**

SpectraSensors™