CUSTOMER CHALLENGES

- Reducing catalyst performance testing time
- Reducing development time and costs
- Maintenance of multiple analytical instruments
- Accurate measurement of low level NO_x
- Speciation of gas components directly without gas conditioning

BACKGROUND

Currently, new catalyst performance evaluations require numerous analytical instruments to measure all species at varying load levels. These analyzers are expensive, costly and time-consuming to maintain, and for many, require extensive sample conditioning. For example, most analyzers require that the moisture level be very low for the instrument to work properly. This sample conditioning has been shown to provide systematic errors in NO_x measurements. Also some gases such as NH_3 cannot be measured directly. In this case NH_3 is converted to NO_x and then analyzed which adds even more complexity and greater potential for systematic error.

SOLUTION

MKS MultiGas Analyzers can measure most catalytic by-products directly, with minimal sample conditioning. At several catalyst R&D centers, the MultiGas analyzer has proven to monitor trace levels of components that are most important - CO, CO_2, CH_4, NO_2, NO, N_2O, NH_3, SO_2, and SO_3 – directly, and in real-time. Typical detection limits are as follows:

<table>
<thead>
<tr>
<th>Contaminant</th>
<th>Typical Detection Limits, in 0 - 10% H_2O absolute</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>0.1 ppm</td>
</tr>
<tr>
<td>CO_2</td>
<td>0.1 ppm</td>
</tr>
<tr>
<td>CH_4</td>
<td>0.5 ppm</td>
</tr>
<tr>
<td>NO_2</td>
<td>0.2 ppm</td>
</tr>
<tr>
<td>NO</td>
<td>0.5 ppm</td>
</tr>
<tr>
<td>N_2O</td>
<td>0.5 ppm</td>
</tr>
<tr>
<td>NH_3</td>
<td>0.2 ppm</td>
</tr>
<tr>
<td>SO_2</td>
<td>0.5 ppm</td>
</tr>
<tr>
<td>SO_3</td>
<td>0.5 ppm</td>
</tr>
</tbody>
</table>

Figure 1: Time line of a catalyst performance evaluation test. Figure used with permission from Johnson Matthey plc, Wayne, PA.
The MultiGas 2030 has a small volume gas cell (200mL) by industry standards; this small volume allows the analyzer to respond quickly to changing conditions. The response time is usually a few seconds, as illustrated in Figure 1, which is 5 to 10 times faster than most FTIR based analyzers. The MultiGas analyzer measures most compounds of interest directly which reduces the number of analyzers required, and inaccuracies associated with converted, secondary measurements. The high-resolution spectrometer also easily speciates (differentiates) hydrocarbons and similar species, as illustrated in Figures 2 and 3 below, eliminating the added expense associated with a gas chromatograph.

Figure 2: Spectral analysis of water (yellow) in NO (blue) which demonstrates the MultiGas differentiation capabilities. Figure used with permission from Johnson Matthey plc, Wayne, PA.

Figure 3: Spectral analysis of water (blue) in NH₃ (yellow) which demonstrates the MultiGas differentiation capabilities. Figure used with permission from Johnson Matthey plc, Wayne, PA.

MultiGas analyzers are easy to maintain with only the gas cell requiring periodic cleaning. The permanent, stable calibration further reduces the need for costly gas cylinders.

Designed for multi-component, continuous real-time gas monitoring, the MultiGas analyzer can efficiently and accurately help evaluate new catalyst performance.

**BENEFITS**

- Direct monitoring of catalytic by-products, including, NH₃, SO₂, and SO₃
- Sub ppm of NOₓ in high levels of moisture, without sample conditioning
- Speciation of hydrocarbons through high resolution spectrometer
- Quick response to changes through low volume gas cell
- Permanent calibration reduces cost of ownership and maintenance costs

**REFERENCE MATERIALS**

MKS Publications:

- Bulletin MultiGas™ 2030

For further information, call your local MKS Sales Engineer or contact the MKS Applications Engineering Group at 800-227-8766.

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