Introduction

Cement is made by heating calcareous and argillaceous materials to a temperature between 1100 and 1500 °C. As this process uses massive amounts of energy, various energy saving measures are taken, including the measurement of oxygen concentrations in exhaust gases to control combustion. To protect the environment, electrostatic precipitators (ESPs) reduce dust emissions and analyzers measure concentrations of nitrogen oxides (NOx), sulfur dioxide (SO2), and other pollutants. Analyzers installed for this purpose are expected to provide stable, long-term performance even under harsh process conditions. Yokogawa process analyzers can be used to measure O2 and CO at the upper end of a kiln or at the outlet of a flash furnace, where high-temperature, dust-laden gases flow. They can also be installed at the outlet of an ESP to monitor dust concentrations and optimize efficiency, and in a smoke stack to measure NOx, SO2, and O2.

Expected Benefits

– Measures gas concentrations and dust concentrations in cement plants
– Reduces operating costs

Sample Conditions at Measurement Points

<table>
<thead>
<tr>
<th>Measuring Point</th>
<th>Condition</th>
<th>Measured Components</th>
<th>Gas Temperature (°C)</th>
<th>Amount of Dust (g/Nm³)</th>
<th>Pressure (kPa)</th>
<th>Gas Component (vol%)</th>
<th>Main measurement system configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: Upper End of Kiln</td>
<td>O2+CO+CO2</td>
<td>1050 to 1200</td>
<td>200</td>
<td>-0.2 to 0.5</td>
<td>2 to 4</td>
<td>Water-washing/cooling probe water ejector type sampling system Model IR200 Infrared gas analyzer</td>
<td></td>
</tr>
<tr>
<td>2: Precalcer Outlet</td>
<td>O2+CO+CO2</td>
<td>600 to 850</td>
<td>100 to 200</td>
<td>-3 to -2</td>
<td>2 to 4</td>
<td>Water-washing (†1) probe water ejector type sampling system Model IR200 Infrared gas analyzer</td>
<td></td>
</tr>
<tr>
<td>3: Suspension Flash furnace Outlet</td>
<td>(O2)+CO+CO2</td>
<td>350 to 400</td>
<td>60 or less</td>
<td>-0.2 to 0.5</td>
<td>3 to 5</td>
<td>Water-washing probe water ejector type sampling system Model IR200 Infrared gas analyzer</td>
<td></td>
</tr>
<tr>
<td>4: ESP Outlet</td>
<td>Dust</td>
<td>100 to 130 (MAX.200)</td>
<td>0.1 or less</td>
<td>-5 to -3</td>
<td>3 to 5</td>
<td>Model DT450 dust monitor (refer to AN 10K02H01-01E)</td>
<td></td>
</tr>
<tr>
<td>5: Stack Inlet</td>
<td>NOx+SO2+O2</td>
<td>100 to 130 (MAX.200)</td>
<td>0.1 or less</td>
<td>1 to 2</td>
<td>3 to 5</td>
<td>Model SG750 stack gas analyzer</td>
<td></td>
</tr>
</tbody>
</table>

NOTE: 1 to 5 represent the measuring points in the summarized process overview for a Cement Plant.

(*1) Water-washing/cooling probe is recommended, when sample gas temperature ≥ 800°C.
O2-CO Measurement System at the Upper End of a Kiln (Wet suction method for high-temperature dust laden gases)

Probe Selection

1: Water-washing/cooling probe
2: Water-washing probe
3: Water-washing probe

Sampling System with Air Blowback Function (Separate analyzer panel type)

Can be used for sample containing dust of up to 1 kg/Nm³.

Note: When measuring only O2 concentration at point 3, ZR22G/ZR402G zirconia oxygen analyzer can be used.

SG750 stack gas analyzer

Increased stability and reliability achieved in combination with a sampling system with excellent maintainability.

Cement Manufacturing Process: Raw materials such as calcareous and argillaceous materials are dried, blended, and pulverized in a mill to create powdered material. The powdered material is preheated and decarbonated in a suspension preheater and flash furnace, and calcinated in a kiln to produce clinker. The clinker is cooled, mixed with gypsum and ground in a finish mill to produce cement.