

Process Analyzers for Stable Long-Term Measurement of High-temperature, Dust-laden Gases

Industry: Cement
Product: Gas Analyzers

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 (NO_x), 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 NO_x, SO₂, and O₂.

Expected Benefits

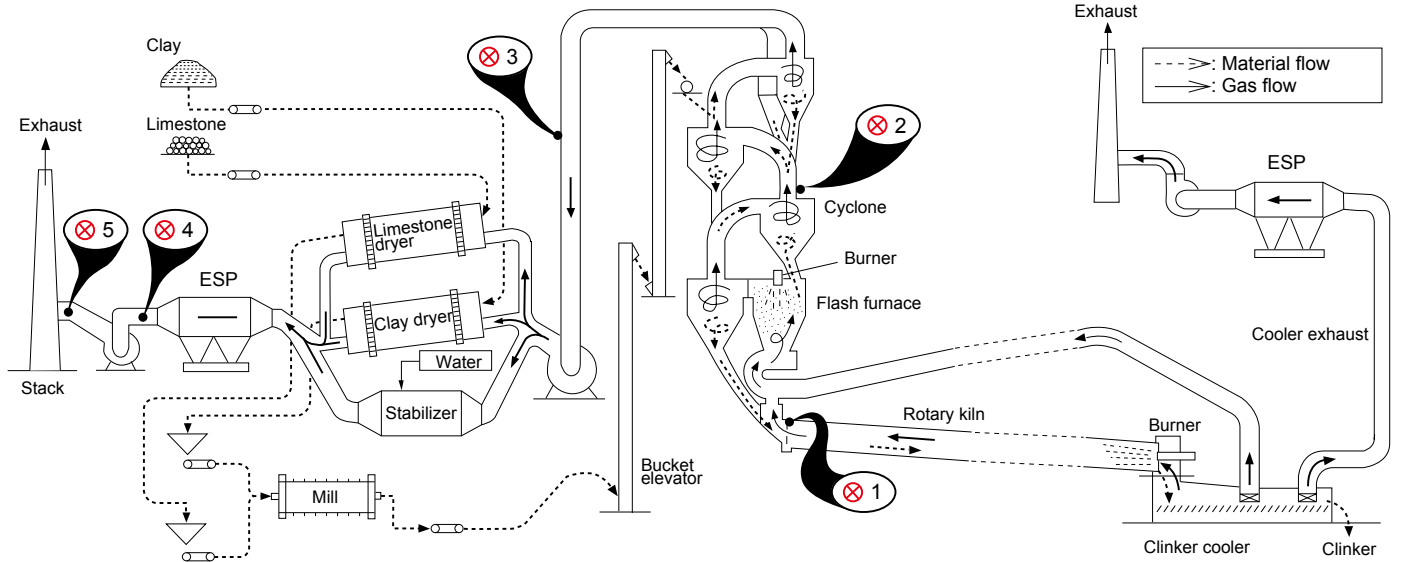
- Measures gas concentrations and dust concentrations in cement plants
- Reduces operating costs

Sample Conditions at Measurement Points

Measuring Point Condition	⊗ 1: Upper End of Kiln	⊗ 2: Precalciner Outlet	⊗ 3: Suspension Flash furnace Outlet	⊗ 4: ESP Outlet	⊗ 5: Stack Inlet
Measured Components	O ₂ +CO+CO ₂	O ₂ +CO+CO ₂	(O ₂)+CO+CO ₂	Dust	NO _x +SO ₂ +O ₂
Gas Temperature (°C)	1050 to 1200	600 to 850	350 to 400	100 to 130 (MAX.200)	100 to 130 (MAX.200)
Amount of Dust (g/Nm³)	200	100 to 200	60 or less	0.1 or less	0.1 or less
Pressure (kPa)	-0.2 to 0.5	-3 to -2	-0.2 to 0.5	-5 to -3	1 to 2
Gas Component (vol%)					
O ₂	2 to 4	2 to 4	3 to 5	3 to 5	3 to 5
CO	0.2 or less	0.2 or less	0.2 or less	0.2 or less	0.2 or less
CO ₂	23 to 26	23 to 30	23 to 30	23 to 30	23 to 30
H ₂ O	9 to 11	9 to 11	9 to 11	10 to 15	10 to 15
N ₂	Remaining	Remaining	Remaining	Remaining	Remaining
SO ₂	0.1 or less	0.1 or less	0.01 or less	0.01 or less	0.01 or less
NO _x	0.01 or less	0.01 or less	0.01 or less	0.01 or less	0.01 or less
Main measurement system configuration	Water-washing/cooling probe water ejector type sampling system Model IR200 Infrared gas analyzer	Water-washing (*1) probe water ejector type sampling system Model IR200 Infrared gas analyzer <small>(*1) Water-washing/cooling probe is recommended, when sample gas temperature ≥ 800°C.</small>	Water-washing probe water ejector type sampling system Model IR200 Infrared gas analyzer	Model DT450 dust monitor (refer to AN 10K02H01-01E)	Model SG700 stack gas analyzer

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

Process Overview



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.

X 1 **O₂-CO Measurement System at the Upper End of a Kiln** Years of experience in high-temperature dust laden gas application
X 2 **(Wet suction method for high-temperature dust laden gases)** Probe Selection Probe should be installed so that the probe head points upward at an angle of 5 to 15° to the horizontal.
X 3 **Water-washing/cooling 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 X 3, ZR22G/ZR402G zirconia oxygen analyzer can be used.

Probe Selection
 Details of part A: Jet wash, Wash water diffuser, Cooling water return, Cooling water intake, Wash water intake, Sample gas + Wash water + Dust.
 Details of part B: Washing water, Sample gas + Wash water.

NOTE: The probe must be installed upward 5 to 10 degrees.

X 5 **SG700 stack gas analyzer**
 Increased stability and reliability achieved in combination with a sampling system with excellent maintainability

