PROCESS SENSORS CORPORATION

Application Note

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ROTARY KILNS

Rotary cement kiln looking towards the burning zone

Rotary kilns are cylindrical furnaces that rotate on their long axis. They are constructed with a steel shell and a refractory lining. The axis of rotation is tilted so that the material is continuously fed into the high-end and travels down the furnace toward a burner at the low end, and discharges onto a conveyor. The conveyor transports the material to a cooler before further processing.

Rotary kilns are used in a variety of processes; cement, paper, hazardous waste, burning of rubber tires, but also in the production of high temperature refractory materials such as Dolomite. Kilns operating at lower temperatures are used to calcine lime as well as urea for processing of fertilizer.

Accurate temperature measurement is essential to ensure product quality and throughput, to minimize emissions, and to prevent damage to the kiln shell and material handling conveyors.

Critical applications are the Burning Zone, Process Material Pre-Heat, Kiln Shell, Clinker Cooler and Conveyor. Although thermocouples have been used in the past, they are quickly eroded or broken off by the abrasive process material. Slip rings are required to pick up T/C signals, and contact is often lost due to slip ring oxidation and wear. Non-contacting Infrared Thermometers (IRT) are therefore more reliable.

Process Material Preheat

Exhaust gases from the kiln are used to preheat cold raw material before they flow to the scrubbers and then the stack. This improves the efficiency of the process and reduces emissions. Inadequate preheating can signal problems in the heat exchanger that reduce efficiency.

Models PSC-CS-laser-2MH, DG40-N, or Sirius SI16 can be sighted on the preheated material to provide an alarm if the temperature falls below a pre-set level.

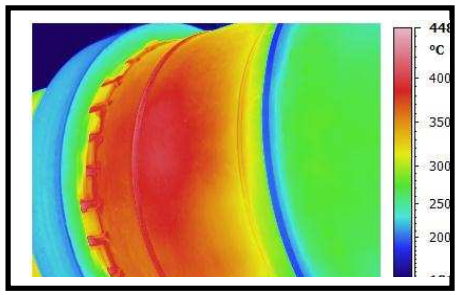
Burning Zone

The burning zone is the last stage before the material exits the kiln. A single burner fires towards the approaching material. An IR thermometer (IRT) must be sighted along the axis of the burner flame and have a spectral response of 3.9µ to exclude radiation from the flame. Process Sensors Model MY39 utilizes this specific wavelength. Nevertheless, a 2 color IRT Model MQ11 is generally preferred because it eliminates the effects due to variable obscurations from smoke or dust. In addition, it offers optionally, an integral video chip that provides a real-time, visible image of the burning zone.

The Metis MV09 Thermal imaging Camera with 300,000 points of measurement, is used to profile the temperature in the kiln discharge area. Cooling and purging accessories are essential for reliable operation.

Kiln Skin Temperature

Hot spots, or cold spots on the kiln outer surface are caused by a ring-dam formed by the build-up of process material in the kiln. This reduces the flow of material, resulting in a hot-spot downstream of the ring, and a cold spot where the ring has formed. Collapse of the refractory lining will also result in a hot spot.



Thermal image of kiln shell hot-spot close to bearing ring at left.

Uneven heating of the kiln shell causes distortion of the metal skin so that the cylinder becomes banana shaped, damaging the bearings on which the kiln rotates, necessitating a process shutdown for repairs.

Rapid detection of uneven heating allows the plant operators to break down the ring with a canon shell, or to "steer" hot process material into any gaps in the refractory lining, as a temporary solution.

The early detection of hot or cold areas can be achieved with an IRT mounted on a mechanical rotary scanner, or a portable or fixed thermal imager, which provides a real time contour picture of the skin, in temperature related colors (See picture above).

Process Sensors Metis MI16, Sirius SI16, DT-40N or PSC-CS-laser-LT is recommended for use with a scanner. Process Sensors also offers a variety of fixed and portable thermal imagers with varying degrees of sophistication.

Clinker Conveyor

Hot process material leaving the kiln is conveyed under cooling water sprays before travelling to ball mills to be ground into powder. Failure to cool the material thoroughly can result in fires along the conveyor in inaccessible locations, or in the ball mills.

Detection of inadequately cooled clinker is therefore critical. An IRT with a wide angle field of view, PSC-CS-laser-LT, DT40-N, & Sirius SI16, or a thermal imager to provide a temperature profile of the material being conveyed such as the PSC-Surveyor Camera is used for this application.

Complete specifications for all the models mentioned can be downloaded from our web page:
http://www.processsensorsir.com