Wireless Technology Improves Cement Rotary Kiln Temperature Readings

Wireless technology applied to temperature measurement on a cement rotary kiln can reduce costs and improve efficiency.

Process Knowledge

Cement manufacturing consists of three key stages:

- Grinding a mixture of limestone and clay or shale to make a fine "rawmix"
- Heating the rawmix to sintering temperature in a cement kiln
- Grinding the resulting clinker to make cement.

In the second stage, the rawmix is fed into the kiln and gradually heated by contact with hot gases from combustion of the kiln fuel. As the rawmix temperature rises, certain elements are driven off in the form of gases and the remaining ones unite to form a new substance with new physical and chemical characteristics.

The partial melting causes the material to aggregate into lumps or nodules, typically of diameter 1-10 mm. This is called clinker, which then necessitates further grinding to obtain the final product.

The rotary kiln consists of a tube made from steel plate, often 3.7 meters in diameter and over 100 meters in length, lined with firebrick. The tube slopes slightly (1-4°) and slowly rotates on its axis at between 30 and 250 revolutions per hour. Rawmix is fed into the upper end and the rotation of the kiln causes it to gradually move downhill. At the other end fuel, in the form of gas, oil, or pulverized solid fuel, is blown in through the "burner pipe", producing a large concentric flame in the lower part of the kiln tube. As material moves under the flame, it reaches its peak temperature before dropping out of the kiln tube into the cooler. Air is drawn first through the cooler and then through the kiln for combustion of the fuel.
**Problem: Temperature Measurement**

Typically, the following temperatures are required to be measured:

- Product discharge temperature
- Product entry temperature
- Mid-Zone temperature
- Combustion gas temperature
- Kiln shell hot spot detection

The traditional techniques used to measure the temperature of a rotary kiln, due to extreme environmental conditions, heat, vibration and corrosive atmospheres, have limitations. These include:

**Contact Type:** With this approach special electro-mechanical links are used to transmit the signal: basically a big copper ring is placed around the kiln and the reading of thermocouple mounted inside the kiln is transmitted through brushes getting the electrical signal from the rotating copper ring. Major issues with this implementation include:

- Requires ad-hoc designed electromechanical links to transmit the signal
- Readings are not reliable (dust, dirt, grease, etc)
- Links require maintenance
- The moving cone rolls to enable rotation are pushing the kiln up, while the inclination and the mass of the material flow are pushing the kiln down. The result is a dynamic equilibrium difficult to be kept and it’s easy to have a 30-40cm tolerance in the movement. This makes the contact measurement even more difficult and expensive.
- Adding measurement points is expensive
- The cost of this solution is 45-70KEURO per kiln
- Bearing thermocouples are subject to wear due to friction between the measuring point and the kilns rotating surface, failures of the measurement system can occur at any time.

**Non-Contact Type:** Infrared pyrometers measure the surface shell temperature of the kiln. Infrared pyrometers require special protection, water cooling jackets to prevent damage to the device due to the extreme temperatures.

Also, air purge systems are needed to ensure the pyrometer lenses are not obscured by dust or other contaminants.

![Gas and solid temperature profiles in the rotary kiln](image)

![The rotary kiln and the heavy traditional contact type method to measure temperature.](image)

![Infrared pyrometers are used to overcome contact measurement.](image)
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Risks

The major risks to process operational performance include:

- Low accuracy and reliability of the temperature measurement can lead to increased energy costs
- Non scheduled maintenance can generate unexpected non planned costs
- Unscheduled down time leading to loss of production.
- Inconsistent product quality due to out of spec kiln temperatures

Solution

The latest wireless temperature measurement technology helps mitigate the risks to accurately measuring temperature. Temperature sensors are mounted directly to the rotating kiln with the readings sent to the control and monitoring system through wireless communication, without any external wiring. This solution is easy to install and requires no special knowledge to benefit from the simplicity and effectiveness of thermocouple reading without all the technical and process issues related to the kiln movement.

The wireless transmitter is installed on the rotary kiln external surface and is getting the reading from the thermocouple installed inside the kiln. A mechanical cover is mitigating the heat irradiation from the kiln surface, protecting the transmitter electronics from the high temperature.

The temperature transmitter sends real time data to a wireless receiver installed not far from the rotary kiln. The receiver is connected either with a 4-20mA or a Modbus connection to the control system.

The XYR 5000 wireless temperature transmitter: no external power supply or data transmission wires are required

Honeywell wireless technology delivers the effectiveness and ease of a traditional thermocouple measurement without the difficulties introduced from the kiln movement

Additional installation time, maintenance, plant unavailability lead to a cost increase
Benefits

Honeywell’s OneWireless temperature technology:

- Ensures accurate repeatable temperature measurement contributing to maintain product quality.
- Reduces wastage due to out of spec product.
- Reduces kiln energy requirements hence reducing costs.
- Minimizes process down time due to maintenance, helps to ensure maximum kiln throughput and production targets are maintained.

Wireless cost effective and reliable solutions will solve current issues and contribute to plant profitability

More Information

For more information on OneWireless, visit our website www.honeywell.com/ps/wireless, or contact your Honeywell account manager.

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