Solution Note

Honeywell

Cement Rotary Kilns temperature reading

Wireless technology applied to temperature measurement on a cement rotary kiln can reduce costs and improve efficiency. This note explains the value of the solution.

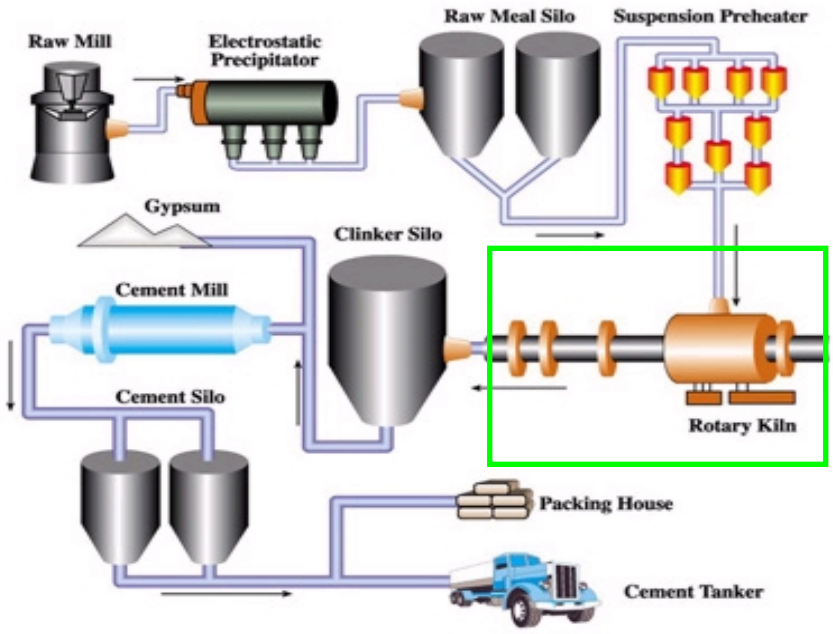
Process knowledge in pills:

The manufacturing of cement consists of three key stages:

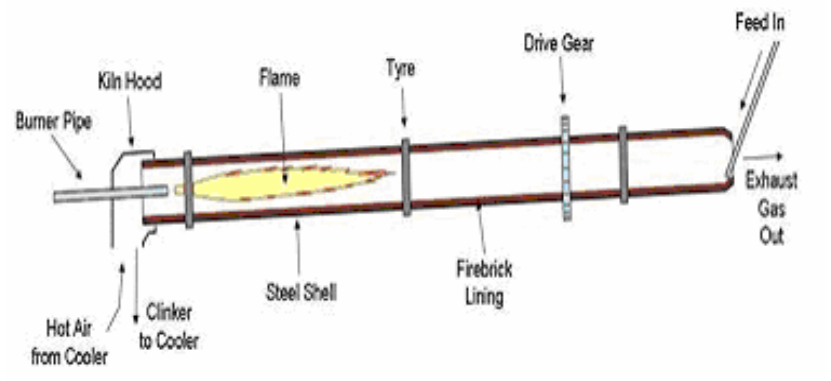
- grinding a mixture of limestone and clay or shale to make a fine "rawmix"
- heating the rawmix to sintering temperature in a cement kiln
- grinding the resulting clinker to make cement.

In the second stage, the rawmix is fed into the kiln and gradually heated by contact with the hot gases from combustion of the kiln fuel. As the temperature of the rawmix 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, and this is the reason for further grinding to get the final product.

The **rotary kiln** consists of a tube made from steel plate, often 3.7meters 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 in at the upper end, and the rotation of the kiln causes it to gradually move downhill to the other end of the kiln. 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.



A schematic layout of a Cement Plant



An example of rotary kiln

Problem: Temperature measurement

Typically the following temperatures are required to be measured:

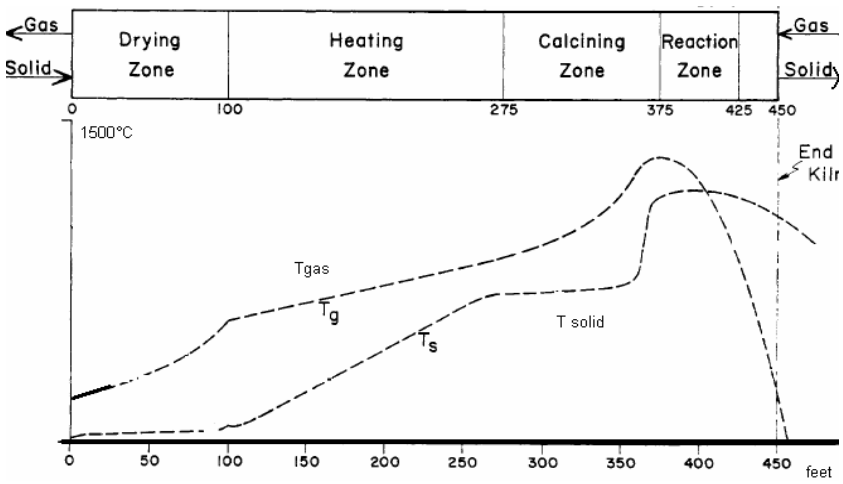
- Product Discharge Temperature
- Product Entry Temperature
- Mid-Zone Temperature
- Combustion Gas Temperature
- Kiln Shell Hot Spot Detection

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

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 electirical signal from the rotating copper ring. Major isses are:

- Requires ad-hoc designed electro-mechanical 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 - Infra red pyrometers measure the surface shell temperature of the kiln. infra red 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

The rotary kiln and the heavy traditional contact type method to measure temperature

Infrared pyrometers are used to overcome contact measurement

Risks:

The major risks to process operational performance are:

- 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

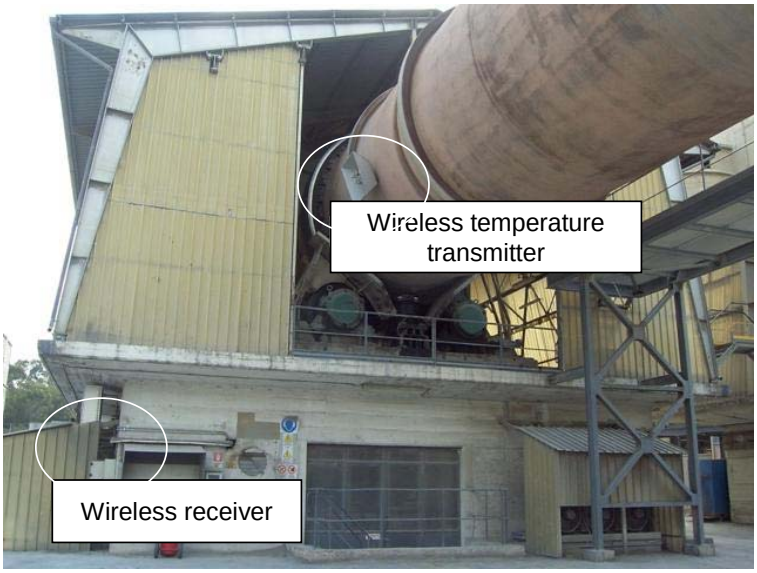
Additional installation time, maintenance, plant unavailability lead to a cost increase

Description of the solution:

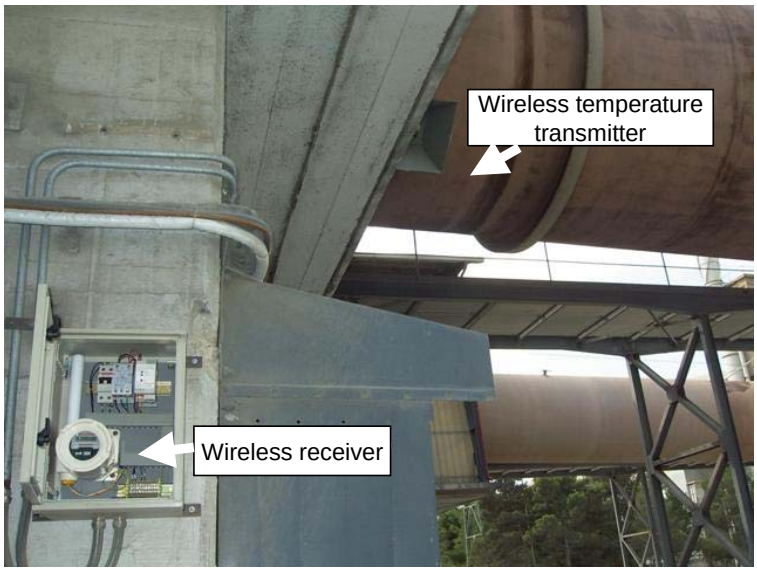
The latest wireless temperature measurement technology helps to mitigate the risks highlighted before: temperature sensors are mounted directly on to the rotating kiln, and the readings are sent to the control and monitoring system through wireless communication, without any external wiring. This solution, quick and easy to install, with no special knowledge required, leaves the simplicity and effectiveness of thermocouple reading, removing all the technical and process issues related to the kiln movement.
The cost of this solution can be approximately 5K EURO per Kiln.

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 Wireless Temperature Transmitter: no external power supply or data transmission wires are required



Honeywell wireless technology allows the effectiveness and easiness of a traditional thermocouple measurement removing difficulties introduced from the kiln movement

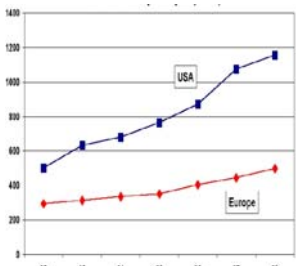


The radio receiver gets the readings from the temperature transmitter rotating with the kiln

Benefits:

Honeywell Wireless 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, reliable solution will solve current issues and will contribute to plant profitability

For More Information

Learn more about how Honeywell's [product/ solution name goes here] can [insert benefit here, for example, Improve plant performance,] visit our website www.honeywell.com/ps or contact your Honeywell account manager.

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