"THE BEST SYSTEM FOR SINTER PLANT PROCESS OPTIMIZATION"

The IRM group sinter plant optimization system is a complete and well-proven tool for maximizing productivity and sinter quality control. It consists of two proprietary measuring gauges with associated control systems.

The "Permagnag" optimization package measures the iron oxidization of the sinter produced and keeps it at its best level by acting on the coke addition to the raw mix. As known from sintering practice, an optimal sinter iron oxide level provides high mechanical strength, an adequate reducibility for the blast furnace operation and a minimization of the return fines quantity.

The "Permeameter" optimization package continuously determines the optimal air permeability for a given raw mix composition. It controls the amount of water to the mixing drum to optimize the process. It is a far better approach to raw mix quality control than the other conventional methods based on raw mix moisture control.

IRM group has manufactured and installed about 70 of these systems worldwide. The utilization of the combined Permagnag and Permeameter optimization packages has shown immediate pay-back due to better stability of operation, improved productivity and a sharp decrease in fuel consumption.

Applications

Dwight Lloyd sinter plants

Sinter Plant Control Versions

Permagnag Optimization Package includes the sinter magnetic gauge and control system
Permeameter Optimization Package includes the raw mix permeability gauge and control system

Options

Permagnag hot fines cooling table
Permeameter independent gauge
Permagnag Optimization Package

Principle

The quality of the sinter produced in a sinterplant is closely related to the amount of iron oxides (mainly FeO but also Fe2O3 and Fe3O4). The iron oxide levels are determined by the degree of combustion, resulting from the coke proportion in the raw mix.

The quality of the sinter produced is critical from several aspects:

- chemical reducibility has to be high to ensure smooth operation of the blast furnace
- mechanical properties ensure that the sinter produced does not deteriorate during transportation from the sinterplant to the blast furnace. The sinter has to reach and maintain a high impact strength and optimum abrasion index
- sinter cake cooking has to be uniform to prevent excess production of return fines.

Permagnag Gauge

The Permagnag gauge measures the magnetic properties of the iron oxides as soon as the sinter cake is discharged and well before the cooled sinter could be sampled for relevant mechanical and physicochemical properties. This information can be used for operator-guide or closed loop control of sinter quality.

The sensing head is especially designed for high resistance to sinter abrasion and is equipped with all necessary sensors to monitor its operation. The sensing head is installed as close as possible to the exit of the sinterstrand, located after the return fines screening. Electronics consists of a cabinet with one industrial PC and interfaces. The Permagnag measurement is arbitrarily expressed as a magnetic index (MI) ranging from 0 to 100 %.

In practice, the measurement of the sinter magnetic properties is performed on a continuous stream of return fines sampled at a rate of 0.5 t / hour. As well established by experience, the properties of the hot return fines are directly related to those of the blast furnace sinter. These hot returns have to be rapidly quenched in order to avoid any modification of their degree of oxidation. For this purpose, IRM group also developed a special water-cooled vibrating table. In case the plant is equipped with “on strand cooling”, the sample is taken under the main screen in the return fines flow.

Permagnag Control System

The Permagnag control system is a PC based industrial controller embedded in the Permagnag electrical cabinet. By acting on the coke addition to the raw mix, it ensures that the Magnetic Index (and thus the sinter FeO content) is stabilized at the optimum set-point to ensure proper sinter chemical and physical properties.
Permeameter Optimization Package

Principle

The quality of the sinter cake cooking process, from the ignition hood to the strand exit, depends significantly on how the air passes through the cake by the fans located below the strand. The air permeability of the sinter cake can be characterized by the air flow rate crossing the raw mix.

The permeability of the raw mix is directly influenced by the addition of water in the mixing drum. In addition, natural influences such as the proportion of mineral components (ores, return fines, coke...), their grain size or their initial surface moisture all affect the permeability of the raw mix. A lack of surface moisture leads to a drop in bed permeability and hence in strand productivity, whereas excess moisture entails the formation of sludges, irregular sintering and clogging of the feeding system.

Traditional control of raw mix moisture by means of moisture gauges is not sufficient to control optimal operation because the relationship between moisture and permeability is not linear. On the contrary, the addition of water in the drum under the control of a direct measurement of the raw mix air permeability allows increasing the amount of the water to the maximum possible value for given operating parameters. This ensures the highest sintering speed and the optimal burn-through point.

Permeameter Gauge

The Permeameter gauge measures the raw mix permeability in the strand feeding hopper or in an independent device charged continuously with a representative sample of the raw mix by measuring the air flow rate blown through the raw mix at constant pressure. The gauge includes all necessary sensors (temperature, pressure, flow...) actuators (control valves...) and monitoring devices to ensure a reliable and maintenance-free operation.

Permeameter Control System

The Permeameter Control System optimizes the water addition in the mixing drum by combining two automatic control loops:

- "permeability set-point" loop automatically adapting the permeability set point in order to optimize the strand performances
- "water addition" loop maintaining the permeability set-point as determined by the "permeability set-point" loop or by the sinter plant operator in manual mode. This loop acts on the water control valve feeding the drum.