

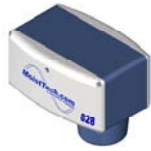
NIR Application Data Sheet

Moisture in Sinter Mix

Introduction

Sinter is produced as the feedstock of the blast furnace production of iron and steel. The sinter plant receives iron-ore fines, which may be of variable composition. To these are added coke, flux and undersized sinter (returned fines) to generate a raw mix. A pre-mixing system known as Bedding is employed to keep composition variations at a minimum. A Bed will last for two or three weeks. The raw mix is conditioned by adding water and sometimes, burnt lime, bentonite and other additions to form a homogenous pre-ignition mix. The mix is ignited on a moving grate and the flame is forced through the mix under the influence of forced air and fans which remove the waste gases. Complete burning occurs by the end of the grate and the hot sinter is crushed before passing through a hot screen. Sinter below 6mm is returned to be reused (returned fines). The larger sinter passes through coolers before being cold screened. Here the sinter greater than 50mm goes for crushing and re-screening. Fine particles below 15mm are used as returned fines. 15-25mm particles are used as a Hearth layer below the pre-ignition mix on the grate and the final portion 25-50mm diameter is the usable sinter for the blast furnace.

The moisture content of the pre-ignition mix is very important since it affects the finished quality of the sinter. Moisture content is inversely proportional to the permeability of the sinter. As already mentioned the flame passes through the bed by forced air. Thus for the shortest burn-through time permeability must be maximum. This occurs at around seven percent moisture content.



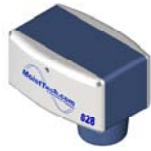
NIR Application Data Sheet

Sinter Moisture Affects Permittivity – if permeability can be controlled there are several benefits to the process. The product is of the highest quality, the output is maximized, the process costs are reduced. Another benefit is the reduction of stoppages for maintenance and repairs.

Measurement Possibilities

Near infrared analysers can be used to measure the moisture in Sinter mix on-line to give a fast accurate result. Permeability can be measured directly off-line. Methods involve drawing air through a sample of sinter. Since the sinter mix is basic and corrosive this contact invariably means high maintenance costs due to its effects. The results are only true for the samples analysed and at best only an indication of the whole sinter mix. Moisture can be measured by oven drying. Oven testing takes over one hour for each sample. It is necessary to use many replicate tests to give a reliable measurement. Suitable facilities are needed to run the tests. Other moisture methods involve nucleonic testing. These require bulky shielding and protecting and protection during use, bearing in mind the health and safety regulations for handling radioactive materials.

They also require frequent standardisation because the source intensity is continuously decreasing. Infrared analysis has many advantages over these methods. The analyser can be mounted directly over the sinter strand to continuously monitor the moisture content. The sensing head is small and since there is no contact with the sinter it is not subject to corrosion. Maintenance costs are kept to a minimum. Results are displayed on a constantly updating display. The display may be remote from the sensing head and a signal may be used in a feedback loop to automatically control the addition of water.



NIR Application Data Sheet

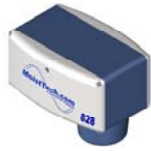
Applications Evaluation Report

Evaluation

A single sample of Sinter was supplied.

An NIR spectrophotometer was used to determine the characteristics of the Sinter Mix.

An oven test showed that this sample had a moisture content of 4.94%. The sample was divided into sub-samples and conditioned to give a range of moisture values by wetting with a fine spray of water. The samples were allowed to stand for two days in sealed containers to allow the moisture to equilibrate throughout the sample. Samples were measured using a IR3000 NIR Analyser. The sensing head was mounted 250mm above the sample at an angle of 20 degrees to avoid specularly reflected light. The sample was presented on a turntable to simulate on-line presentation. Data was collected from the gauge as it viewed samples, using MoistTech data collection software. Four replicated readings of six seconds were taken on each sample. The results from the four readings were averaged to give the sample gauge output. Reference values for each sample were obtained by oven testing for two hours at 120°C. Three replicate ten gram portions of each sample were used, and the average of the three values used as the reference value. The reference values were added to the data file and the results analysed using MoistTech calibration software.



NIR Application Data Sheet

Results

The calibration was found to be linear over the range of interest.

The accuracy found in the laboratory was $\pm 0.1\%$

Conclusions

The moisture content of sinter mix may be measured using the MoistTech IR3000 NIR Analyser. The results will be fast, on-line, and accurate. The calibration will be stable with possible changes only occurring when the Sinter bed is changed. The change would be a simple zero shift caused in composition of the iron ore. If the composition is similar this calibration change may not be necessary. MoistTech have a great knowledge of analysing moisture in Sinter Mix and we have many years experience of the measurement. The expected accuracy of the measurement is $\pm 0.1\%$ over the range 5–12%.