HANDHELD XRF

Slag Analysis

In-Process Steel Slag Analysis with CTX Portable XRF Spectrometer

Slag is a complex silicate mixture of aluminum, calcium and magnesium with small amounts of manganese, iron oxides and calcium sulfide. This mixture forms during different stages of iron and steel processing including in the blast furnace, the converter, the basic oxygen furnace (BAF) and the electric arc furnace (EAF).

In the blast furnace, for example, impurities in iron ores (the gangue), the flux and the coke ash react together to form slag. The slag then reacts with the molten iron that is being smelted, where it removes impurities whilst leaving desired elements in the melt – helping result in a purer steel or alloy product.

The monitoring of slag composition during the steelmaking process is a critical step for process optimization. Real-time slag composition monitoring provides steelmakers with advantages such as efficient slag formation and with it, lower material and energy costs, as well as higher quality steel or alloy products.

CTX portable XRF spectrometer

The CTX portable benchtop spectrometer is based on the principle of energy dispersive X-ray fluorescence (EDXRF) and enables the detection of a broad spectrum of elements from as light as magnesium (Mg) to as heavy as uranium (U). The analyzer is ideal for rapid non-destructive analysis of small or prepared samples, i.e. solids, powders and liquids. Wherever fast and accurate testing is required, the CTX provides accurate and reproducible results quickly and easily.

The CTX portable benchtop XRF analyzer is a rugged instrument for field operation in all environments, including humid and dusty conditions. The splash-proof stainless steel housing is durable and easy to clean.

Slag analysis using the CTX

The balance of oxides such as silica (SiO_2), calcium oxide (CaO), aluminum oxide (Al_2O_3), and iron oxide (FeO) is essential for the process efficiency and service life of the furnace refractory lining. The steelmaker can ensure the correct balance of these oxides by frequent analysis and raw material additions during production.

The CTX can detect a wide range of oxide forming elements in slag, including silicon, aluminum, magnesium, calcium, iron, and many others. The analytical accuracy of the CTX is typically comparable to traditional analytical methods, which are often time-consuming, expensive, and require lengthy sample preparation. The portability of the CTX means slag analysis can be carried out on-site reducing sample transport and laboratory time.

The CTX portable XRF analyzer can be used close to the furnace to measure slag, allowing the quick adjustment charging conditions in near real time.

When using portable XRF for slag monitoring, sample preparation is important to ensure high quality results. For quick results at the furnace, a coarse crush analyzed with an averaging function can provide useful results. For higher quality results, the slag can be ground to a fine powder to ensure homogeneity.

Slag sample and slag analysis result measured with CTX.

Benefits of portable XRF for slag analysis:

- Fast, almost real-time results for key slag elements and compounds
- Increased efficiency and productivity, reduced laboratory costs
- Analysis of raw materials such as iron ore, scrap and limestone
- Analysis of finished products and ferroalloys

In conclusion, Bruker's CTX is a powerful slag analysis tool that can increase steelmaking productivity and end product quality through rapid analysis. Its ability to provide accurate, real-time results close to the furnace opens up new opportunities to make the steelmaking process more efficient.

All configurations and specifications are subject to change without notice.
Order No. DOC-H83-EXS004 Rev. 1. © 2025 Bruker Nano GmbH, Am Studio 2D, 12489 Berlin, Germany.

Bruker AXS
Info.baxs@bruker.com

www.bruker.com/slag