



Preparing BOS slag and lime samples with one pulverizer

Abstract

The pulverizing machine HP-MA from HERZOG is especially suitable for preparation of pressed powder pellets for analysis by means of XRF. The HP-MA with its broad range of parameter and cleaning features allows a contamination free preparation of materials with diverging properties and element content. The HP-MA is available as a standalone machine or can be integrated into automated systems.



Fig.01: Lime (left picture) and BOS slag particles (right picture).

Keywords

• Grinding • pressed pellets • lime • Basic oxygen furnace slag (BOS) • contamination • steel industry

Introduction

Grinding and pelletizing is an efficient and cheap sample preparation technique especially when the results have to be obtained within a short time in order to control production processes. Steel making with a basic oxygen furnace (BOF) requires the addition of lime to optimize the slag composition. Therefore, it is necessary to determine the composition of both slag and lime. Usually, it is recommended to use two separated preparation lines (one for the slag and one for the lime) to avoid possible contamination between the two different sample types. Due to the inbuilt cleaning system of the HP-MA it is possible

to run both sample types in one pulverizing machine simply by using sand or water cleaning in between each sample.

Here we evaluate the efficacy of the cleaning process aiming at using only one HP-MA for pulverizing both lime and slag. For that purpose different samples were prepared and analyzed using an Epsilon 3 ED-XRF instrument. The samples were blended with the grinding aid HMPA 40 to allow the pressing into steel rings for analysis.

	Lime	Slag	Unit
Sample weight	15	15	g
Grinding aid*	4	8	g
Addition	1 g copper matte		

*HMPA 40 (cellulose & waxy component)

Parameter

Lime

Milling HP-MA

Milling 1	60 s
Speed 1	1,400 rpm
Pills	4
Milling 2	0 s
Speed 2	1,400 rpm
Pills	0
Discharge	35 s
Discharge speed	800 rpm

Pressing HP-PA

Force	150 kN
Ramp up	10 s
Ramp hold	10 s
Ramp down	15 s
Difference	130 kN

Slag

Milling HP-MA

Milling 1	60 s
Speed 1	1,400 rpm
Pills	2
Milling 2	15 s
Speed 2	1,400 rpm
Pills	6
Discharge	35 s
Discharge speed	800 rpm

Pressing HP-PA

Force	160 kN
Ramp up	10 s
Ramp hold	10 s
Ramp down	10 s
Difference	75 kN

Measurements

To examine potential contamination two sample sequences were investigated. Accordingly, one slag sample was prepared followed by one lime sample and the other way around. Since the lime sample provides no specific peaks, which can be used as an indicator for contamination, the sample was blended with 1 g of copper matte (65 % Cu). The Fe-peak (6.398 keV) was used as an indicator for contamination of the lime caused by a prior slag sample. The Fe-background for lime samples was determined to be 0.5 % (Fig. 02). The effect of brief grinding a small quantity (30 g) of quartz sand between two subsequent samples compared to cleaning only with compressed air was examined.

The samples were examined according to following test protocols:

- A) Slag → Lime // Slag → Sand cleaning → Lime
- B) Lime +Cu → Sand cleaning → Slag
- C) Lime +Cu → Sand cleaning → Lime

A) Slag → Lime // Slag → Sand cleaning → Lime

In the first test scenario a slag sample was followed by a lime sample. Since no sand cleaning was interposed the subsequent lime sample was contaminated as shown by an increased intensity of the Fe-peak (Fig. 03 blue spectra). The same test was repeated with interposed

sand cleaning. In this case the lime sample showed no enhanced Fe-peak (Fig. 03 orange spectra). The counting rate for Fe is similar to those of the blank lime sample shown in figure 2.

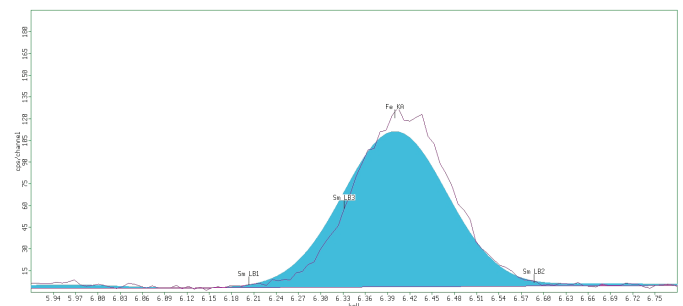


Fig. 02: Fe-peak of a lime blank sample.

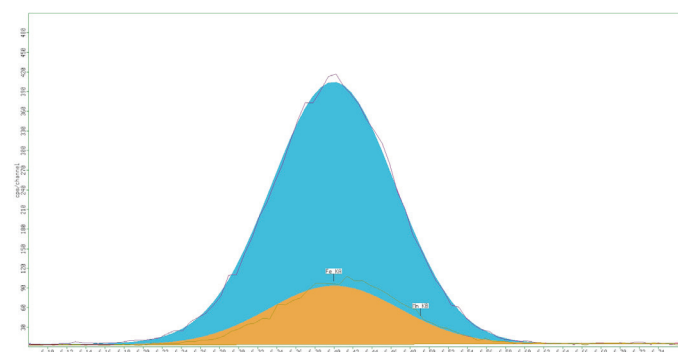


Fig. 03: Fe-peaks of a contaminated lime sample (blue) compared to the Fe-peak of a lime sample after interposed sand cleaning.

B) Lime +Cu → Sand cleaning → Slag

In the second scenario the copper blended lime sample (Fig. 04) was followed by a slag sample after sand cleaning was interposed. In the spectra of the slag sample no copper peak (8.04 keV) was present (Fig. 05).

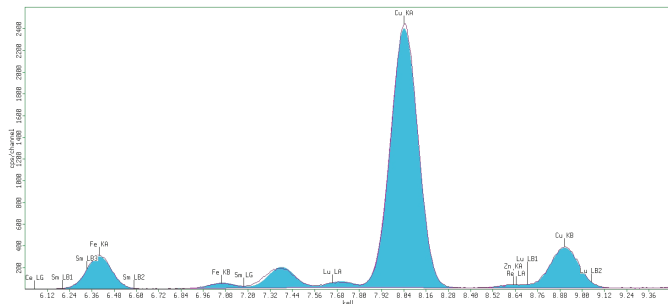


Fig. 04: Lime sample blended with copper of test B.

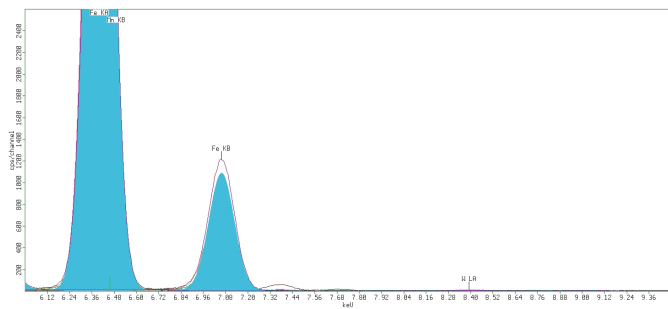


Fig. 05: Slag sample after cleaning shows no peak for copper.

C) Lime +Cu → Sand cleaning → Lime

In the third scenario the copper blended lime sample (Fig. 06) was followed by a copper free lime sample after sand cleaning was interposed. In the spectra of the second copper-free lime sample no copper peak (8.04 keV) was present (Fig. 07).

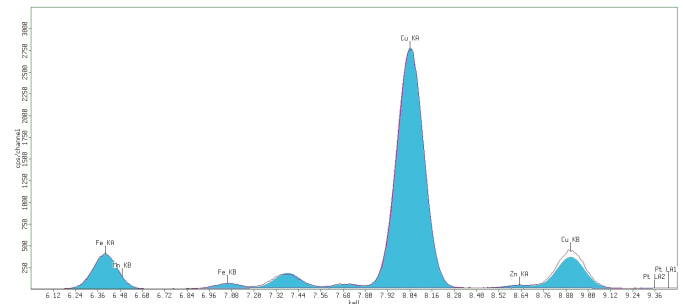


Fig. 06: Lime sample blended with copper of test C.

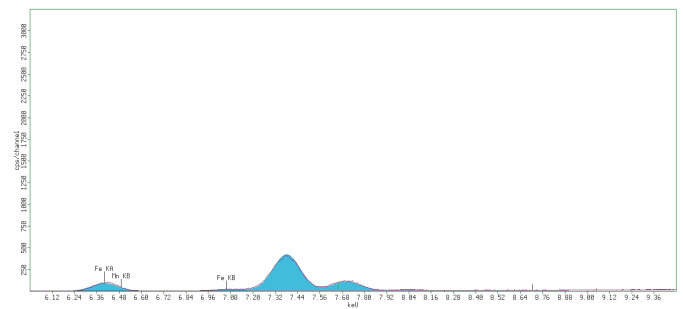


Fig. 07: Lime sample after cleaning without copper peak.

Conclusion

To avoid contamination of a following sample the grinding vessel has to be cleaned by a proper amount of quartz sand and compressed air in combination. This cleaning step allows the preparation of slag and lime samples with one grinding machine like the HP-MA supplied by HERZOG.

For further details about the possibilities of sample preparation with the HP-MA and related products please contact us.

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