

# Direct slag analysis with Laser OES – Efficient BOF, EAF and LF management

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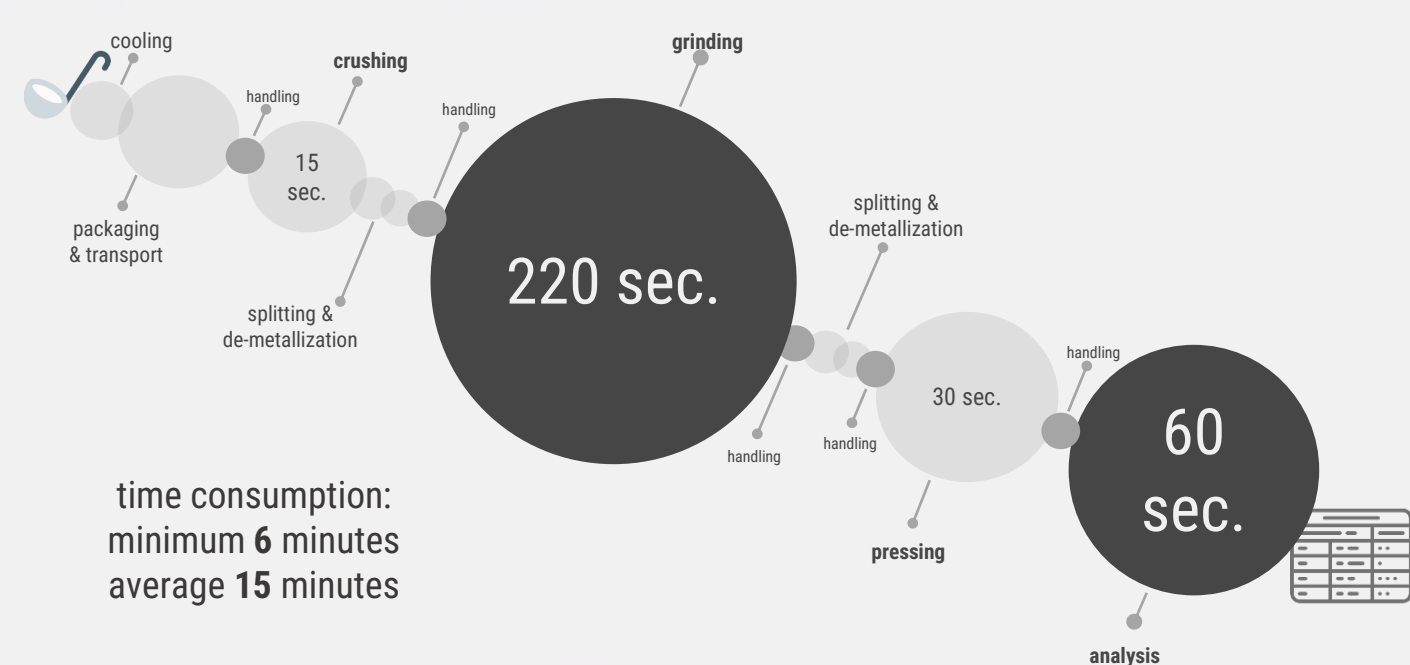
## Introduction

Do you know your slag? In-situ or post-mortem? Since the sample preparation takes too long, BOF, EAF, and LF lose efficiency due to missing slag analysis.



## Today's analysis

Crushing, grinding, pressing and analysis usually take around 15 min. Waiting that long costs a lot of energy, and continuing production without slag analysis leads to reduced efficiency.



## Tomorrow's slag analysis

With Laser OES, the advancement of Spark OES, the direct slag analysis, without sample preparation reduces the overall analysis time way below 1 minute.



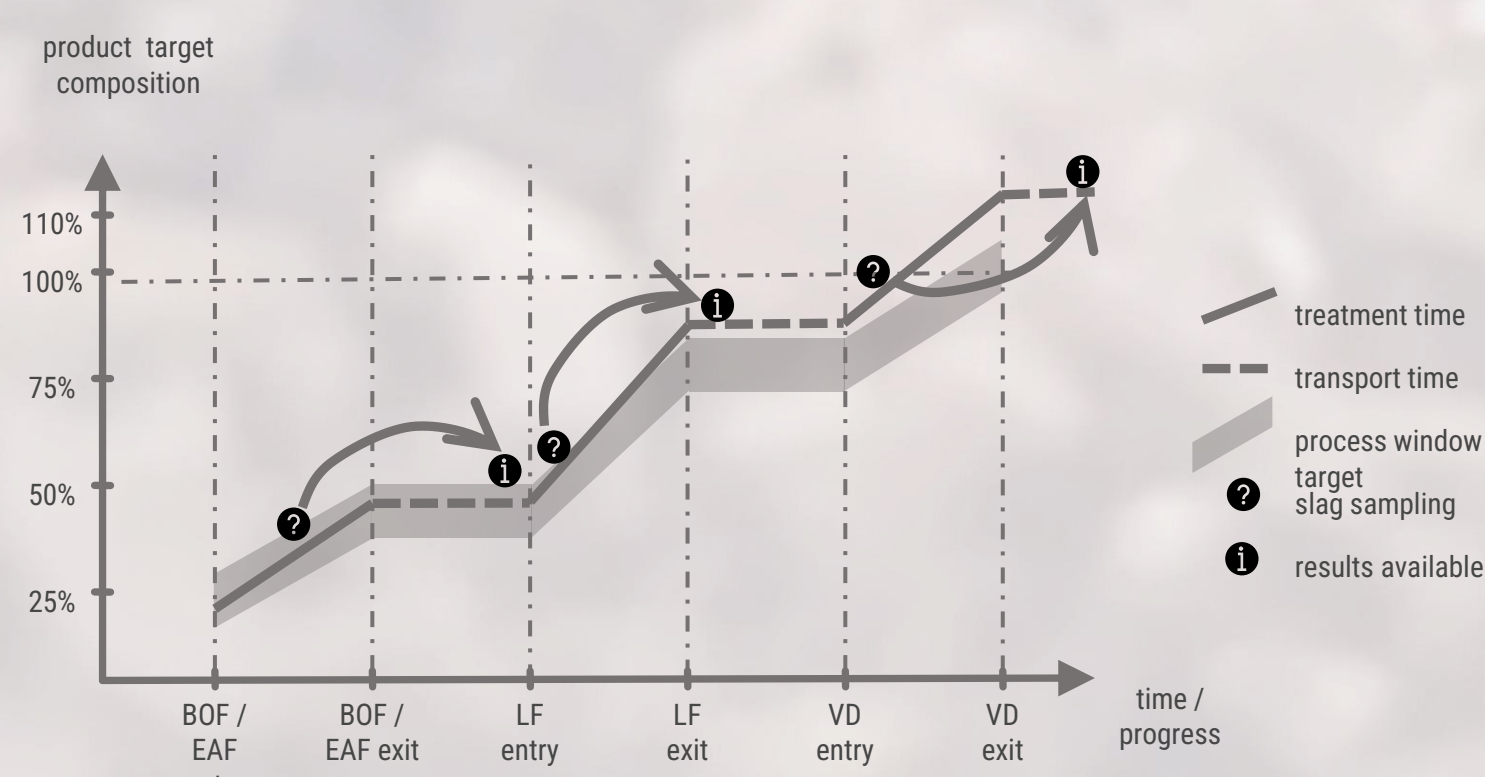
## Sample vs data homogenization

A pulverization is a thing of the past now since Laser OES collects thousands of spectra each second. In comparison: It took 10 seconds and more for previous analysis approaches to collect one measurement value. Laser OES homogenizes measurement data instead of the samples. This is not only fast but also smart in regards to Industry 4.0.



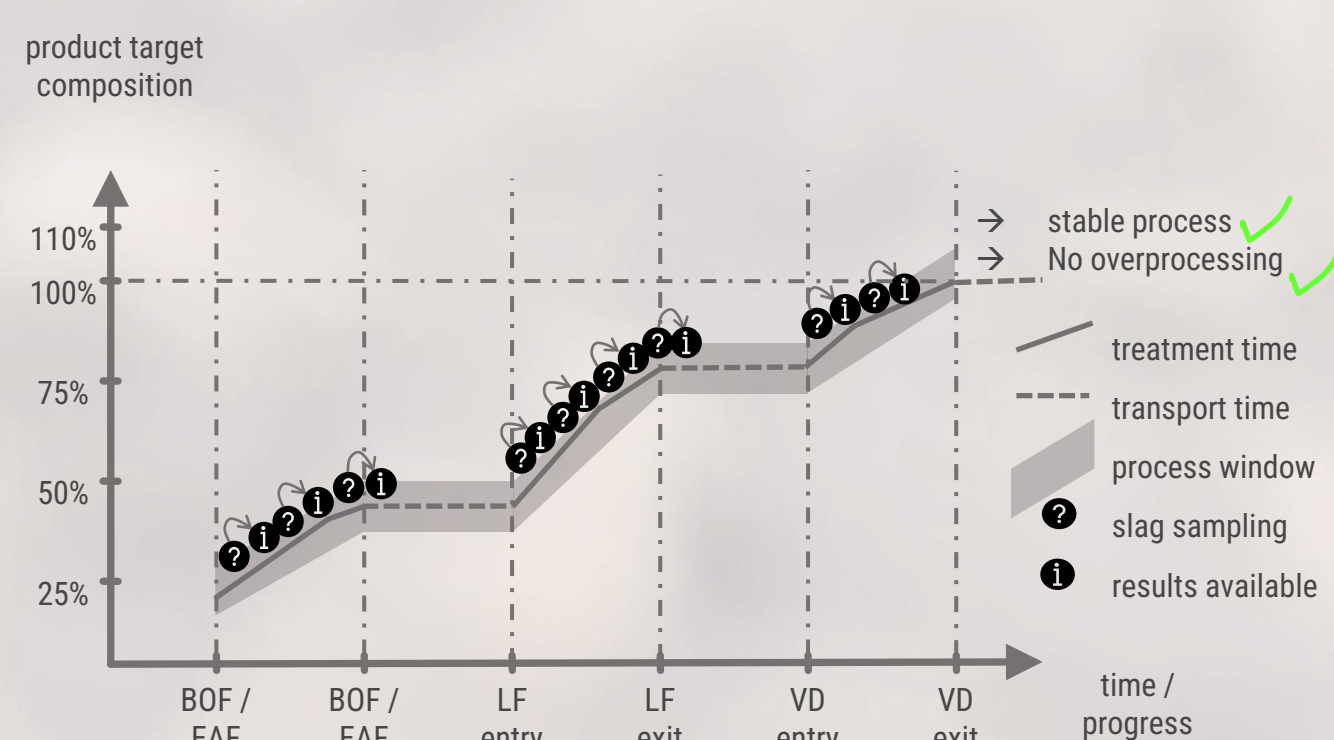
## From Post-Mortem...

The lengthy analysis leads to post-mortem evaluation since the melt is already processed further when the slag analysis is available. The process window needs to be more comprehensive, holding additional buffers, and the efficiency is not as high as it could be.



## ...to In-Situ analysis

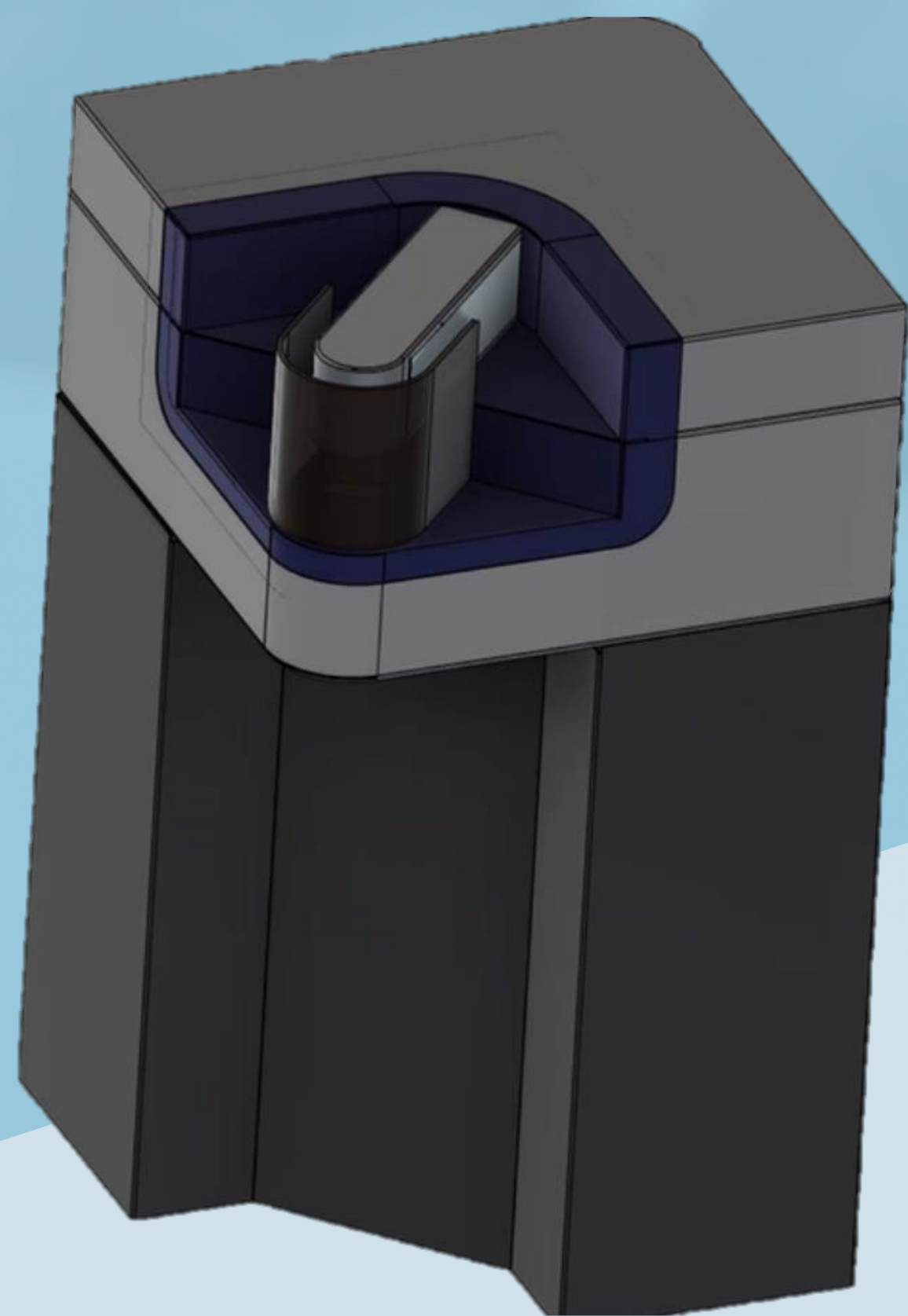
The high-speed analysis allows a quick process adaption while the simplicity facilitates an increased number of samples. Deviations are detected as soon as they appear, and the more stable process holds the benefits described in this paper.



## About LaserOES

Laser OES is an Optical Emission Spectrometry where a Laser ignites a plasma on the surface of a sample. Spark OES established the spectrometric detector technology decades ago, so Laser OES builds on well-known analytics.

Among others, the advantages are a measurement rate in the multi-digit kHz range, the capability to analyze conductive and non-conductive materials, and the possibility to measure without contact. The laser is a very stable and maintenance-free plasma excitation source. For that reason, Laser OES systems have been trustworthy for years with a minimum of maintenance.



## About QuantoLux

Convinced that the Laser OES represents the future of the OES, the founders started QuantoLux. From day 1, the mission was to offer analytical instruments with the same quality and competitive pricing as Spark OES devices but with the advantages of Laser OES.

## The QXL9

The high-end Laser spectrometer allows the direct analysis of around 60 ml of slag in less than 30 seconds. In the laboratory or next to the furnace. Additionally, calibration and maintenance are easy since the QXL9 offers great calibration tools.



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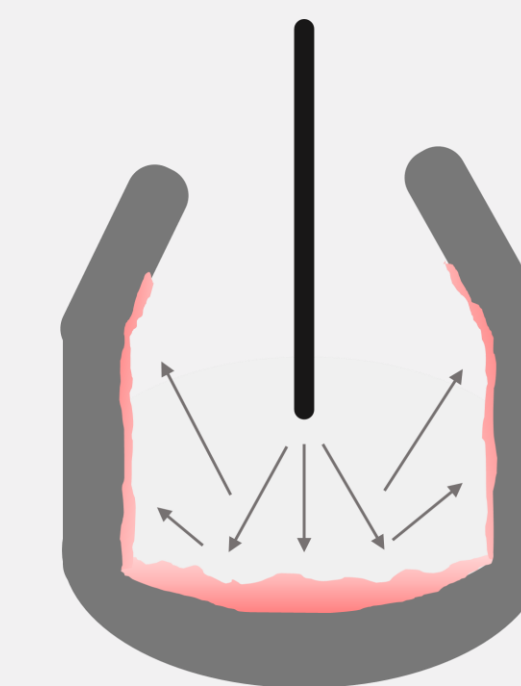
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## Goodbye waiting times - benefits of the impossible

In the past, the analysis of a slag sample took at least 7 minutes. Taking a slag sample, crushing it while still being hot, and analyzing it directly was impossible in the past. This rapid analysis gives melt shop operators the chance to adapt the melt in-situ which optimizes various existing melt shop parameters. But there is more than just the optimization of established procedures. Since now becomes possible what was nearly unthinkable before, the rapid slag analysis allows rethinking the whole process.

### Converter splashing on demand

Making a profound, analysis-based converter splashing / no splashing decision was impossible in the past. With the rapid slag analysis, the MgO saturation and the basicity can be checked precisely, right before / right after tapping of the steel. Unnecessary/unsuccessful splashing belongs to the past.

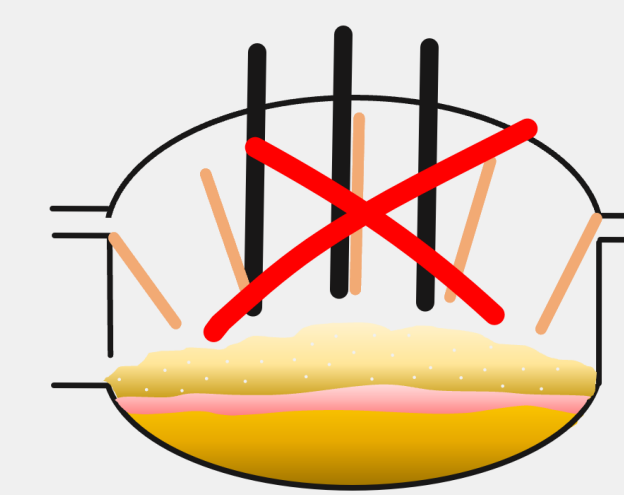


tapping →  
slag analysis  
→ splashing decision

✓ splashing on demand  
↑ refractory protection

### Improved foaming = insulation

Establishing the correct basicity with closely meshed and rapid slag analysis ensures the optimum foaming and the best insulation possible. The insulation holds significant energy savings, especially for melt shops with extensive metallurgical treatment in the EAF.



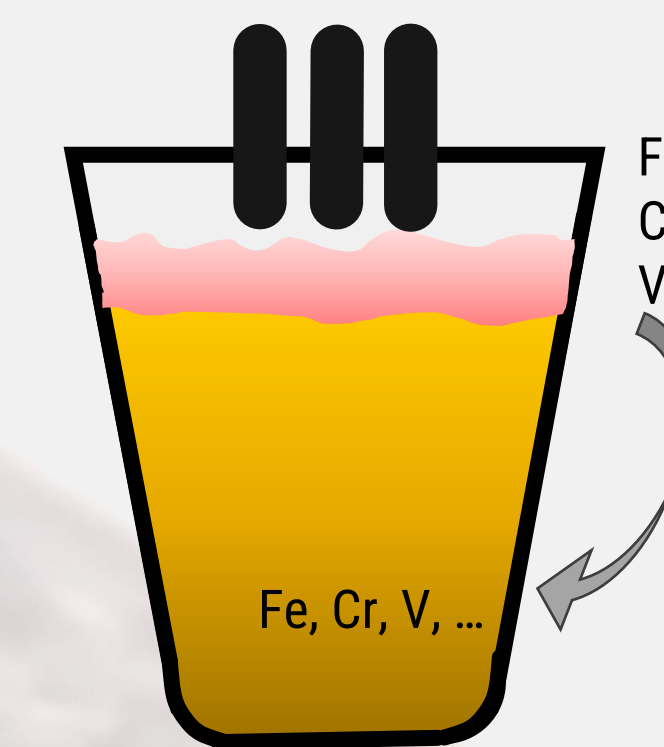
scrap melting →  
slag analysis  
→ recipe alignment

✓ pinpoint process control  
✓ sufficient insulation  
↑ energy efficiency

### Metal oxidization, overtreatment

Stable processes supported with high-frequency rapid slag analysis also prevent the Fe and alloying metals from oxidizing into the melt. That reduces ferroalloy consumption, increases Fe yield, and saves money, e.g., limestone purchasing.

Furthermore, having the slag analysis on hand while the ongoing processing helps determine the treatment's end-point precisely in 10-seconds steps. Crossing out overtreatment supports energy- and equipment efficiency.

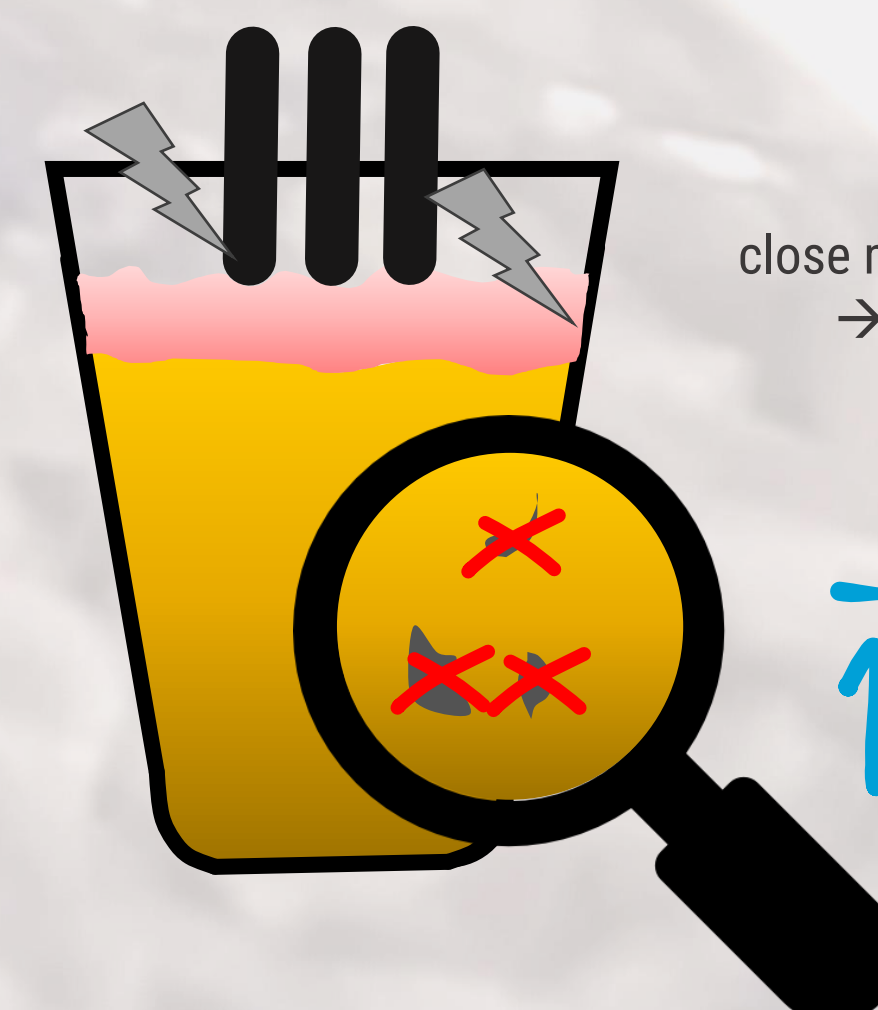


FeO, Cr2O3, V2O5, ...  
oxidization of Fe

oxidization of alloys

### Clean Steel, refractory- and ladle wear

Pinpoint raw material calculation, and closely-meshed sampling ensures the perfect basicity at all times. That prevents refractory and ladles from too aggressive slags and increases their lifetime. The maximized stability also allows cleaner steel production since non-metallic inclusions are avoided.



close meshed sampling  
→ fast analysis  
→ pinpoint process control

precise basicity  
↑ refractory & ladle lifetime  
✓ clean steel

### Easy disposal

Knowing the slag composition, before tapping the melt shop operator adjusts the slag composition according to the by-product-sale/disposal strategy. Even after steel tapping, e.g., a post-tapping LF slag treatment is possible. The additional heating energy and processing time tackle the overall efficiency, but in certain circumstances, the advantages of easy slag disposal can compensate for the disadvantages.



tapping →  
slag analysis  
→ post-treatment decision

↑ byproduct sale  
↓ landfill disposal