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Slag Management: The Most Under- and Over-Estimated Success Factor in EAF Steelmaking

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Make the slag, and the steel makes itself. This expression underlines a central idea in electric arc furnace (EAF) steelmaking: slag is a key part of the process, even if it is not part of the product. "Good"slag influences energy consumption, refining quality, and overall process stability. However, recent findings strengthen the impression that today's slag analysis methods often do not match the importance of slag itself.

Most steel plants analyse slag as pressed pellets using X-ray fluorescence (XRF). While this method works well for many laboratory samples, it has clear limitations when applied to granular, non-homogeneous slag. XRF also has known analytical challenges for light elements such as Si, Mg, and Al. These weaknesses become visible when different laboratories analyse the same material.

A recent round-robin test with granular slag samples revealed substantial differences between laboratories, especially for key oxides. For example, one laboratory reported 39.8% Al_2O_3, while another measured 35.8% Al_2O_3 (outliers already removed) for the same sample. This raises an important question: How can a slag engineer make reliable process decisions when analytical results vary this much? The round-robin results show clearly that the default method is not always precise enough for robust process control—especially when decisions based on these results can easily cost thousands of euros per heat and millions per year.

A promising alternative is rapid slag analysis using Laser OES. This technology requires no complex sample preparation and provides fast, precise measurements. In the round-robin tests, the accuracy of Laser OES was comparable to fused-bead XRF results, while delivering data much faster. This allows operators to obtain near real-time feedback and make precise, timely adjustments to slag practice.

This presentation will show the performance limits of today's common slag analysis approach, present modern alternatives, and discuss the possible impacts on EAF process control. With better analytical tools, the idea that "make the slag, and the steel makes itself"becomes increasingly achievable.

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