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More dynamic carbon injection: a novel approach for slag foaming control in EAF steelmaking with continuous charge feeding

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Direct Reduced Iron (DRI) is increasingly utilised as an alternative metallic charge in electric arc furnace (EAF) steelmaking for flat product manufacturing, due to stringent quality standards required for these steel grades. It is also being adopted in long product production, where scrap availability is often a bottleneck.
DRI quality fluctuations require continuous adjustments to the melting process. Currently, manual control largely remains the norm for the EAF process in most continuously fed production units.
Contrary to common belief, flat bath operation is more difficult to automate than batch process. It requires skilled personnel and prevents the possibility of applying a fully reproducible standard melting profile. Here is where most of the state-of-the-art schedulers are failing.
DRI is fed at a high rate. The energy required for melting is largely determined by the quality of the feedstock, particularly factors such as total iron, metallization, gangue, and carbon content. Physical properties of the iron ore pellets, such as grain size distribution and the proportion of fines, significantly impact EAF performance beyond the reduction process itself.
Variations in these properties directly affect both energy consumption and furnace productivity. Even small changes in energy requirements can significantly impact melting behaviour, potentially causing unmolten material to accumulate and disrupting process management—occasionally resulting in unexpected reactions or equipment failures.
How to help operators to anticipate and contain those variances, adapting the process variables? How to standardize operations reducing the standard deviation of the key process indicators?
This paper describes how MORE technology and process expertise can improve operations. A controller works collaboratively with operators to optimise process efficiency, dynamically adjusting chemical package set points to automatically regulate foaming slag arc coverage and maximise energy input efficiency.
A process supervisor agent detects drifts and adjusts variables automatically when possible, reducing the need for continuous manual intervention by the operator. The operator assistant agent offers targeted suggestions, supporting the operator's role in deciding the melting strategy.
The application to their EAF in a long-term cooperation with EZDK flat division will be described, analysing the achieved results and improvements.

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