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Smelter technology to close the raw material gap in green steel production routes

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The transition to green steel faces several challenges: raw material availability, green electric energy availability, and the associated cost. Direct reduction (DR) is a promising solution for reducing CO2 emissions in ironmaking. While natural gas-based DR is established and new plants are ready for operation with green hydrogen, the high costs of natural gas and hydrogen in Europe increase operational expenses. Additionally, most iron ore available and currently used in BFs is of medium to lower grade with high gangue content, resulting in high slag amounts if processed in established DR –EAF route.
Electric arc furnaces (EAFs) focus on melting, final reduction and refining of direct reduced iron (DRI) made from high-grade ores with low gangue content. However, the availability of such high-grade ores is limited and lower grade ores with high gang content limit EAF productivity, increase yield losses, and raise consumption figures. Hence, a two-step process combining an electric smelting furnace (Smelter) with a BOF converter offers a more efficient solution. The Smelter's reducing conditions and long residence times allow efficient processing of DRI from low-grade ores, maintaining high iron yield and producing slag suitable for the cement industry. Refining in the BOF converter keeps existing steel plant processes and logistics unchanged, eliminating the need for re-certification.
The Smelter can be combined with natural gas or hydrogen-based DR plants and can handle different DRI sizes, from briquettes to pellets and fines. This paper compares different DR plants in combination with EAF or Smelter and BOF regarding CO2 emissions and energy demand. It discusses the influence of DRI carbon content and metallization degree on EAF and Smelter productivity, consumption, and CO2 emissions, and provides an overview of Smelter process validation tests with various DRI compositions and sizes.

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